A NEW SYSTEME OF THE MATHEMATICKS:

Cha: Chamberlayne

CONTAINING

I. ARITHMETICK, as well NATURAL and DECIMAL, as in *Species*, or the *Principles* of ALGEBRA.
II. Practical GEOMETRY, together with the first *Six* Books of *Euclid's* ELEMENTS, as also the *Eleventh* and *Twelfth*, symbolically demonstrated.
III. TRIGONOMETRY PLAIN and SPHERICAL.
IV. COSMOGRAPHY, or a DESCRIPTION of the *HEAVENS*.
V. NAVIGATION, or SAILING by a *Plain* or *Mercator's Chart*; as also by the *Arch* of a *Great Circle*, &c.
VI. The DOCTRINE of the SPHERE, grounded on the *Motion* of the *Earth*, according to the Old *Pythagorean* and *Copernican Systeme*.
VII. Astronomical TABLES, with Tables of *Logarithms*, Natural and Artificial *Sines* and *Tangents*, and *Versed Sines*.
VIII. A New GEOGRAPHY, or a *Description* of the most Eminent *Countries* and *Coasts* of the WORLD, with *Maps* of them, and *Tables* of their *Latitude* and *Longitude*.

Composed by Sir JONAS MOORE *Knight*,
Late Surveyor General *of His* MAJESTY's Ordnance, *and Fellow of the* ROYAL SOCIETY:

And designed for the Use of the Royal Foundation of the *Mathematical* SCHOOL in CHRIST-HOSPITAL.

By His MAJESTY's *special Command*.

LONDON,
Printed by A. Godbid and J. Playford for ROBERT SCOTT, *Bookseller* in *Little Britain*, M. DC. LXXXI.

TO THE

KING.

May it please Your Majesty,

IT *is not from any forgetfulness of the* Reverence *due to Your Sacred* NAME, *that the Publishers of this* Treatise *have presum'd to give it this Dedication; they well knowing, how much better it had suited with their* humble state, *could it as well have stood with their* Duties, *to have sought for* Patronage *from any lower, or (indeed) other Hand than Your* MAJESTY'S, *to a Work, not only undertaken by Your immediate Command, and by a Person, who held it his highest Honour, and no less Happiness, to have the most* valuable *part of his Life exercis'd and finish'd in Your Majesty's Service; but destin'd also to the particular* use *of that part of Your* Royal Care, *the Children of Your Own*

a Mathe-

Mathematical Foundation *in* CHRIST'S-Hospital: *Which, by the Munificent Provision Your Majesty has made for the Improvement of* Naval Knowledge, *and the necessary Advantages of* Maritime Dominion *and* Commerce, *depending thereon, will let Posterity see how much more it owes on that Subject to Your* single Name, *than to the* united Performances *of all Your Royal Ancestors.*

In contemplation whereof, and of our Duties therein paid to Your MAJESTY, *as well as Respect to the Memory of Your* Servant, *our late honoured* Father-in-law, *Sir JONAS MOORE, its* Author: *We do in all humility lay this our* Collection *of his* Labours *therein at Your Sacred* Feet, *being,*

(May it please Your Majesty)

Your Majesty's most loyal and obedient Subjects and Servants,

WILLIAM HANWAY,
JOHN POTENGER.

THE PREFACE.

SIR *JONAS MOORE*, the Author of the ensuing WORK, was a Person, who, by his eminent and known skill in the *Mathematics*, had attain'd to very considerable Employments in his MAJESTIES Service. Some Years before his Death, he was chosen one of the Governours of *Christ's-Hospital*, LONDON, whereupon considering with himself the Advantage and Benefit, which the Nation might reap from a *Mathematical* School, if duly managed, he made it his earnest business to promote the improvement of it. His MAJESTY had of his own Bounty, and by the Mediation of His Royal Highnesse, then Lord High Admiral of *England*, been pleas'd to Order a liberal Allowance, for the Maintenance of a Select number of the ablest and

fitteſt Youths of the ſaid *Hoſpital*, to be Annually choſen, as alſo for that of a Maſter, to inſtruct them, in ſuch Parts of the *Mathematics* as are requiſite in a Skilful *Sea-man*.

The *School* was ſetled; but there ſtill wanted a Methodical *Inſtitution*, from which the Youths might receive ſuch neceſſary helps as their Studies required. A laborious Work! from which the great and aſſiduous Employments of Sir *Jonas* might juſtly have exempted him, had he not made this reflection, That he could not have better beſtow'd the ſpare Hours of his declining Age, or done a thing more acceptable to His MAJESTY (to whoſe Service he had Dedicated his All) than by contributing what lay in his power to the improvement of ſo hopeful a Seminary of Sea-men.

Having thus engag'd himſelf in the proſecution of this generous deſign, the firſt thing to be determin'd was his *Method*. The whole enſuing Work he reſolved to divide into *Four Parts*. The firſt of thoſe ſhould comprehend the *Rules* and *Principles* of *Arithmetic*, *Vulgar*, *Decimal*, and *Logarithmical*; *Practical Geometry*, *Trigonometry Plain*, and *Spherical*; *Coſmography*, and *Navigation*: And that the other Three Parts ſhould conſiſt of a Volume of *Aſtronomical Tables*; a conciſe *Geography*, ſomething of *Aſtronomy*, *Algebra*, and the moſt uſeful Books of *Euclide*'s Elements. But in what Order theſe Three laſt were to ſucceed each other, appears not otherwiſe, than that the *Algebra*, and *Euclide*, were to Compoſe the laſt Part; whence it may be collected, that the Tables of *Geography* and *Aſtronomy*, were to make up the two middle Parts.

The

The *Arithmetic*, *Practical Geometry*, *Trigonometry*, and *Coſmography* were writ by Sir *Jonas* himſelf, and Printed during his Life time. In which, if the *Style* and *Method* ſhall, by ſome, be thought not ſo exact, as might have been expected from a Perſon of his great repute; Or if the occaſional *Repetitions* of his Principal Rules, and Applications to the Youths of the *Mathematical* School, ſhall be cenſur'd as a blemiſh to his Work, it may be anſwer'd for him, That intending them chiefly for the Inſtruction of the ſaid Youths, he concluded nothing would more engage their diligence, than ſuch familiar Addreſſes to them, and that accordingly, ſuch Repetitions may be of good uſe. For tho' Perſons of riper Years, and more mature Judgments may, upon the firſt peruſal, underſtand what they Read; yet when ſuch green wits are to be Taught, there is a neceſſity of repeating and reinculcating the Ground-work Rules, and Principles, upon every occaſion.

Whilſt the forementioned Part was paſſing through the Preſs, Sir *Jonas* had procured the *Algebra*, with the firſt Six Books of *Euclide*'s Elements, as alſo the Eleventh and Twelfth, to be done by Mr. *Perkins*, the then Maſter of the *Mathematical* School. The *Figures*, which he appointed to be us'd, were thoſe of *Melder*, and, where he ended, thoſe of Dr. *Barrow*, whoſe Method he required to be every where follow'd. The Volumes of *Tables* were Printed off; the *Tables* for the *Geography* all Collected by himſelf; the *Maps* were Engraved; as alſo the *Plates with Proſpects* for Part of the Work. But the *Tables* and *Directions*, for Calculating the Place of the *Luminaries*, and *Eclipſes*, were communicated by Mr. *Flamſted*.

Sir

Sir *Jonas* was ready to enter upon the Chapter of *Navigation*, and conceiv'd himſelf within view of the much deſired Concluſion of his Work, when it pleaſed the Divine Providence, by Death, to put a Period to his Labours; which happen'd anſwerably to his own deſire, to wit, that of ending his days in his MAJESTY's Service.

The Author's known Abilities had raiſed a great expectation of the coming forth of this Work. Many Perſons, but more eſpecially the Learned Sir *Charles Scarburgh*, and *Samuel Pepys* Eſq; with others, the Governours of the *Hoſpital*, were very Sollicitous to have it Publiſhed. But upon Sir *Jonas*'s Deceaſe; all was at a ſtand, for many Months; till ſuch time as his Son-in-law, Mr. *Hanway*, came over from *Ireland*, and vigorouſly concern'd himſelf in haſtening the Publication of this uſeful and much-deſired Work. His Endeavours therein were ſeconded by thoſe of Mr. *Potenger*, another Son-in-law of Sir *Jonas*'s; they being reſolved, what ever pains or Charges they were at, to ſee it perfected. Some Part of the *Geographical* Plates had been, by the mutual conſent of the Parties concern'd therein, deliver'd into the Hands of the *Hoſpital*. But when the Workmanſhip thereof came to be examin'd, it was found, that great faults were commited in them by the Engraver. The *Tables* and *Diſcourſe* belonging thereto were imperfect. Nothing of the intended *Navigation* (of Sir *Jonas*'s) could be met withall. Whereupon it was agreed, that Mr. *Edmund Halley* ſhould be intreated to peruſe the *Geography*, and to add what was wanting in it; which he willingly undertook. An Explication of the *Copernican Hypotheſis* was promis'd by Mr. *Flamſted*; and Mr. *Perkins*, who was like to be moſt concern'd with it, undertook the *Navigation*: Mr. *Hanway* and Mr. *Potenger*, making it their Province to have the Plates neceſſary for each Part, Engraved, as they were Tranſmitted to them, defraying the Charges thereof, and urging all convenient Expedition both from the Preſs, and the Undertakers.

The Work being thus carry'd on with great vigour, the *Doctrine of the Sphere* was firſt finiſhed, and Printed off; then the *Geography*; and Mr. *Perkins* had but juſt compleated the *Navigation*, when it pleaſed God, to conclude his Life with his Work, and to deprive the School of an able and diligent Maſter. Of the ſaid Chapter of *Navigation*, it may reaſonably be affirm'd, That it has the advantage of any other Treatiſe Publiſhed upon that Subject. Within the Compaſs of ſome few Pages, he hath, with great perſpicuity, Taught the three ſeveral ſorts of *Sayling*, viz. by the *Plain Chart*, *Wright's*, or *Mercators*, and the Arch of a great Circle. He hath ſhewn, how the uſual Propoſitions in each may be wrought either *Arithmetically*, *Geometrically*, or by the *Gunter's-Line*. To which he hath added a new and a very eaſy Method of keeping the true reckoning of a Ship's way; the Deſcription of ſuch Inſtruments as are moſt approv'd, for Obſervations at Sea; together with the ways of Obſerving therewith. And in the uſe of the *Azimuth-Compaſs*; he hath been very expreſs, and more copious than uſual; for this reaſon, that our Seamen account the finding of the *Variation* one of the moſt difficult things in their practice. His *Method* ſeems every where the ſame which

which he usʼd in his *School*; and it is not to be doubted, but that his Succeſſors will find it both moſt inſtructive to their Diſciples, and eaſy to themſelves.

After this ſhort account of the Work, and the accidents which retarded its coming abroad at the time it was at firſt deſign'd, this may be further added, That whereas the Author makes Mention of a Preface of his own Writing, wherein he had advertis'd the Youths of the neceſſity of *Arithmetic*, and other Parts of the *Mathematics* in their Studies, there was not any thing of that kind found after his Deceaſe. So that, for what is done by way of Preface, the Public is oblig'd to the preſent Editors of this Work, Mr. *Hanway* and Mr. *Potenger*, his Sons-in-law. But with a more particular Acknowledgment to the *former*, for his great Care, Pains, and expence in promoting it, not without extreme detriment to his Affairs elſewhere.

THE INDEX, OR CONTENTS OF THE FOLLOWING WORK.

CHAP. I.

Of ARITHMETICK.

CHAP. II.

Of Practical GEOMETRY.

CHAP. III.

Of Plain Trigonometry.

CHAP. IV.

Of Spherical Trigonometry.

CHAP.

THE INDEX.

CHAP. V.

Of Cosmography.

CHAP. VI.

Of Navigation.

Sect.

ASTRONOMICAL TABLES.

SECOND PART.

ERRATA.

Page.	Line.	ERRATA.
2	10	FOR *Dwillions*, read *Millions*.
3	8	For *out of the*, read *under the*.
5	24	For *one*, read *the one*.
24	5	From the bottom of the Page, for *onely that*, read *onely note that*.
50	12	For *be both a Right-Angle*, read *taken both together be equal to one Right-An.*
53	10	For *by a Right-Angled Triangle*, read *by turning a Right-Lined Triangle about its Axis*.
	11	For *comprised of*, read *comprehended by*.
56	7	For 335, read 355.
	11	For 335, read 355.
	39	For *p l*, read *p d*.
69	5	For *C D E* and *H B E*, read *C B D*, and *F B G*.
	19	For *B G E*, read *B G F*.
70	13	For *Figures* 6, and 10, read *Figure* 7, and 10.
	31	After B C D add Figure 14.
71	9	After as if, put in (Figure 15.)
71	4	From the bottom, for *D E B* read *C E B*, and for *B C D*, read *B D C*.
73	2	For *C I H*, read *C F H*.
74	17	For *C a*, read *c a*.
79	25	For *adscribed*, read *inscribed*.
81	19	For *C A*, read *B A*.
85	19	For *b*, read *d*.
	31	After, *from x to s*, add 105°.
86	18	For *add the second and third Terms*, read *add the Logarithms of the second and third Terms*.
89	4	For *D A*, read *B A*.
99	29	For *a b t*, read *a b f*.
	34	For *from t to l*, read *from f to l*.
104	5 & 6	From the bottom, for *B A*, r. *C A*.
106		Rule 5. Line 29. read *Co-si.* B . R :: *Co-t.* B C . *Co t.* B A.
116	25	For *As Radius, Co-t.* B A :: *Co-si.* B. *Tang.* B A, read it *As Co-si.* B . *Radius* :: *Co-t.* B C . *Co-t.* B A.
119	15	For *Sines*, read *Signs*.
124	12	For *Phenomena*, read *Hypotheses*.
	13	For *to consider*, read *supposes*.
	15	For *to conceive*, read *conceives*.
	21	For *but* 2 *Degr.* read *near* 3 *Degrees*.
125	11	Blot out *Phenomena or*.
135	40	For 29 *Days* and some odd *Minutes*, read 29 *Days* 12 *Hours* and some odd *Minutes*.
	45	For 12 *Minutes*, read 49 *Minutes*.
137	7	For *Yeas*, read *Years*.
141	13	For *C D*, read *C B*.
	15	For *C A C*, read *C A B*.
142	41	For 30 *Minutes*, read 25 *Minutes*.
143	7	For *Retraction*, read *Refraction*.
148	21	For *Ecliptick*, read *Equator*.
149		In the Margin put *Fig.* 2. page 103.
150	13	For *of Midheaven*, r. *of the Midheaven*.
158 and 159		For *Artib Sine*, read every where *Arith Compl. of the Sine*.
168	18	For *Fibration*, read *Libration*.
172	21	For $\frac{1}{31}$, read $\frac{1}{32}$.
174	14	For 30 36 read 30 56.
	21	For 53 16 read 53 26.
177	1	For *A and C the*, read *A and C be the*.
158	3	For *lay* 70 *from A to B*, read *lay* 51 *from A to B*.
186	5 & 6	For 43 54 read 36 05.
	8	For 74.4 read 86.4
		In the Figure through *B* draw a Line Parallel to *A C*, and mark it *F G*.
196	2	From the bottom for 7 read 8, and in the last for 5, read 6.
197	35	For in *b* and *l*, read in *e*, and after from *e* to *n*, add, draw *n l* Parallel to *C c*.
209	4, 6, 14, 17	After *Tangent whereof is*, add *omitting the Characteristick*.
217		In the Figure, through *E* draw *E F* Parallel to *E C*.

Note, that in the Figure Page 283. all the small Letters *f*, *g*, *h*, *i*, *m*, *p*, *r*, *s*, *δ*, *ε*, *λ*. mentioned in the following page, are wanting, whose places may be found, and themselves inserted by the Method prescribed and used in the Figure next preceding it.

CHAP. I.

Of ARITHMETICK.

PREFACE.

YOu (*the Children of the* Royal Foundation) *have been told in the Epistle, that the Method intended for this Work requires, first, to lay down some short Introduction for* Arithmetick, *to the end you may have wherewith to mind you for the Practice thereof, if it happens you forget any of the Rules. I shall not need to inforce any Arguments, to perswade you to be ready and dextrous therein, for that the universal use thereof, whether you be at Sea or Land, requires it; and if you should be but excellent herein, with fair Writing, it is enough to prefer you, if you had no other Art besides. It is the great Difference that distinguisheth us from Brutes and brutish Men, it changes our Natures, sharpens our Understandings, and prepares us for Business. I divide all into Sections and Propositions, as followeth.*

SECTION I.

Of the Common Parts of Arithmetick.

§ 1. *Of Simple Numeration.*

SImple *Numeration* consists in the *Distinction*, in the *Estimation*, and *Pronunciation* of Numbers. Every Place towards the left hand being ten times more than the Place on the right, or in decuple proportion, therefore if any Number of Figures be given, to declare or pronounce what Number it is, first *distinguish* the whole into *Periods*, be- *Numeration simple.*

ginning

ginning with Unity, and taking three Places to each *Period*, as you may see by the Example following.

The Characters are 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, whereof the last is Nullity, or Nothing, or a Cypher, the rest, 1 for Unity, 2 for Duality or Two, *&c.* Secondly, for the value ordinarily estimated, from the right hand as the first place for Units, the second for Tens, the third for Hundreds, Thousands, Tens of Thousands, Hundreds of Thousands, Millions, *&c.* The Estimation will be best by the Periods, the first being of Units, the second of Thousands, the third of Millions, the fourth Thousands of Millions, the fifth Millions of Millions or Dwillions, *&c.* and in every Period there being three Places, that to the right hand being Units, the middle Tens, and the third Hundreds; as 764, is Seven Hundred Sixty Four in the first Period; but in the second Period, it would be Seven Hundred Sixty Four Thousand; if in the third, Seven Hundred Sixty Four Millions, *&c.* So that, lastly, if this Number 7.340.596.712.345.082 were to be pronounced, having distinguished all into Periods, it would signifie Seven Thousand of Millions of Millions, Three Hundred and Forty Millions of Millions, Five Hundred Ninety and Six Thousand of Millions, Seven Hundred and Twelve Millions, Three Hundred Forty Five Thousands, and Eighty Two Units, of whatsoever be assigned.

§. 2. *Of Compound Numeration.*

Numeration compound.

NUmeration compounded contains the Rules of *Addition*, *Subtraction*, *Multiplication*, and *Division*, under which last may be comprehended *Extraction* of the *Square* and *Cube Roots*. The Rules shall follow briefly and in order, for Whole Numbers.

Rule I.

Addition.

ADDITION is the Invention of the Sum of two or more Numbers, and requires the Ordering of the Places so, as Units may stand under Units, Tens under Tens, *&c.* and then the Collecting every Column by it self, and if it fall out to be under Ten, to set it down; if above Ten, set down the odd Units, if there be any, and carry to the next Column so many Tens as the Number shall come to; as in these Examples.

16	34	756	5789	93256
72	68	382	3452	12700
88	102	568	7898	78250
		1706	3257	97662
			20396	15628
				297496

So

So if it be required to give the Sum of any Number of Goods, delivered at several times, *viz.* 50 at one time, 7 at another, 168 at another, and 72 at another, setting them down as before directed, you will find the Sum to be Two Hundred Ninety and Seven.

50
7
168
72
297

Rule II.

Subtraction.

SUBTRACTION is the Invention of the Difference of two Numbers, which are found by subscribing the lesser Number out of the greater, setting Units under Units, Tens under Tens, *&c.* then beginning with the last Figures towards the right hand, take the lesser from the greater, and set down the Remainder under that Figure. If the Figures be equal, set down a Cypher; if the higher be lesser than the lower, add Ten, or call it Ten more than it is, and be sure the next below be made One more, that is, if it be 2, make it 3; if 6, make it 7, *&c.* The Examples will make all easily.

	18	756	8254	567438
	15	431	6332	358784
Rem.	3	325	1922	208654

The Number to be subtracted, together with the Difference or Remainder, are equal to the Number from which the Subtraction was made, which is a good Proof for Subtraction; as in the third Example, 6332 and the Remainder 1922 makes 8254, the first Number.

The Proof of *Addition* is to divide the Parcels, and if the Sum of the Parts be equal to the Whole, all is right.

Rule III.

Multiplication.

MULTIPLICATION is but a Compendium of *Addition*, for the *Multiplicand* (which is the Number to be multiplied) is so often added to it self, as an Unit is contained in the *Multiplier* (which is the Number multiplying;) and so the *Product* is gotten (which is the Result of the Work.)

For the Multiplication of the smaller Figures, under 5, it is so easie, that any Child may do it, as 2 times 2 is 4, 3 times 4 is 12, *&c.* But for those higher, by the Table adjoyning; they must be perfectly got by heart, so that forward, backward, or any ways they may be remembred.

This

5	5	25	7	7	49
	6	30		8	56
	7	35		9	63
	8	40	8	8	64
	9	45		9	72
6	6	36	9	9	81
	7	42			
	8	48			
	9	54			

This Table may be perfectly learn'd in fix hours time, and lefs: Then for multiplying two or more Figures by one Figure, fet down the Multiplicand, and by that one Figure (being the Multiplier) multiply all the Figures of the Multiplicand, remembring to carry in your mind for every Ten, One to the next place.

```
2123 Multiplicand.    31567      38976
   3 Multiplier.          7          9
----                 ------     ------
6369 Product.        220969     350784
```

But if you multiply by more Figures than one, work as before, but fet each feveral Product one place forward towards the left hand, and fet the Unit-place exactly under the Figure you multiply, as in thefe Examples.

```
  3576         32569       35000
   263           527        7000
 -----      --------   ---------
 10728        227983   245000000
21456        65138
7152        162845
------      --------
940488      17163863
```

If there be Cyphers at the end either of Multiplicand or Multiplier, make the Multiplication in the Whole Numbers, and at laft add fo many Cyphers as there are Places of them in one or both, as in the laft Example.

I fhould defire that the Boys fhould learn by heart all the Products of 12, as in the following Table, for they will have great ufe thereof.

2 times

2	times 12 is	24
3		36
4		48
5		60
6		72
7		84
8		96
9		108
10		120
11		132
12		144

Rule IV.

DIVISION is a Compendium of *Subtraction*, for the *Divifor* is fo many times contained in the *Dividend*, as there are Units in the *Quotient*; fo that fubtracting continually the *Divifor* from the *Dividend*, accounting an Unit for each time, the Sum of thofe Units is the *Quotient*. *Divifion.*

The *Dividend* ftands in the middle, betwixt the *Divifor* on the left hand, and the *Quotient* on the right, as in this Example.

In this Example, as in all others of this kind, I confider how many times 3 can be in 6, and find it 2 times, I fet 2 in the Quotient, and multiply that 2 by 3 the Divifor, which makes 6, which I fet under the firft Figure 6, and fubtracting one from the other the Remainder is 0. Then I put down 7, the next Figure of the Dividend, making a Point under it, and fet it after 0; I demand how many times 3 can be in 7? and fet 2 in the Quotient, then multiplying 2 by 3 makes 6, which I take from 7, and there remains 1; after which I add 5, the next Figure, making a Prick under it, and proceed as in the Example, finding the whole Quotient to be 2253, without any Remainder.

```
Divifor. Dividend. Quotient.
   3  )  6759  ( 2253
         6...
         --
         07
          6
         --
          15
          15
          --
           09
            9
           --
            0
```

But if you be to divide two Figures, then the matter will be a little more difficult, and more care will be required to find fit Quotients: Wherefore I advife the young Scholar, that he may the better underftand the Method of chufing due Quotients, to make a Table of all the feveral Multiplications of the Divifor to 9, by which he will perceive where the difficulty lyes, and after he has made his Quotient by the Table and without it, he will be perfect therein, and perceive his Work the better. Let the Dividend be 940488, the Divifor 263, whereof I make a Tariff or Table by doubling or Addition,

1	263
2	526
3	789
4	1052
5	1315
6	1578
7	1841
8	2104
9	2367

dition, as for 2 I double 263 and it makes 526, for 3 adding the first and second makes 789, for 4 I double the second, for 5 I add the second and third, for 6 I double the third, for 7 I add the third and fourth, for 8 I double the fourth, and for 9 adding the fourth and fifth makes 2367, which is 9 times 263.

First I find how far the Divisor will reach into the first Places of the Dividend, which will be to three Places, which is 940: Then I seek how many times 263 will be in 940, and by the Table, seeking for that Number or the next less to it, I find it 3 times, *viz.* 789, which I set under 940 of the Dividend, making a Point as before, and subtract, and it leaves 151; after which I add the next Figure of the Dividend 4, and make a Point under it; then I enquire how many times can 263 be in 1514, and the Table tells me no more than 5 times, *viz.* 1315, which I set down, subtract, and so proceed, 'till I have brought all the Figures of the Dividend down, and find the Quotient 3576, and no Remainder.

```
263 ) 940488 ( 3576
      789
      ----
      1514
      1315
      ----
       1998
       1841
       ----
        1578
        1578
        ----
           0
```

Thus by making such a Table *Division* is easily performed, but this is too tedious, and my Boys must not spare labour, but perform it by their memory and practice, after this manner: Let the same Example be set down.

Seek how many Figures the Divisor will require in the Dividend to be bigger than it self, *viz.* 940, there make a Point, and estimate how many times 2 can be in 9, having respect to the 6 that follows in the Divisor, for though you can have 2 four times in 9, yet four times 26, which is 104, is bigger than 94, therefore it can be but three times; set 3 in the Quotient, and multiply the Divisor 263 by it, and set it (*viz.* 789) to the first Prick, subtract it from 940, and after the Remainder set the next Figure in the Dividend, *viz.* 4; and so proceed 'till you have finished your Division.

```
263 ) 940488 ( 3576
      789
      ----
      1514
      1315
      ----
       1998
       1841
       ----
        1578
        1578
        ----
           0
```

After Division be finished, if any thing remain, it is set over the Divisor in form of a Fraction. If the Divisor hath Cyphers at the right hand, they may be omitted, and so many of the last Figures of the Dividend cut off, and so the Division to be made with the rest of the Figures.

Rule V.

Bipartion.

BIPARTION or Halving, or dividing by 2, is perfectly to be practised, thus: Suppose 782358 be required to be halved; I begin, and say, the half of 7 is 3, and because 7 is odd, I say, the half of 18 is 9, the half of 2 is 1, the half of 3 is 1, the half of 15 is 7, and the half of 18 is 9, which is 391179. And it will be requisit, to learn to divide by 12 at once, as was done in *Multiplication* for that part.

The *Proofs* of *Multiplication* and *Division* are mutually tryed by each other, for the Product being divided by the Multiplier gives the Multiplicand, and by the Multiplicand gives the Multiplier: So likewise if you multiply the Divisor by the Quotient (adding the Remainder of the Dividend, if any such were) the Product will be the Dividend.

Lastly note, That if the Quotient be equal to the Divisor, and that nothing remain, then is the Dividend a Square Number, and the Divisor is the Root. To Extract which, is the next Rule.

Rule VI.

Extraction of the Square Root.

A SQUARE NUMBER, as before was said, has a Side or Root, which multiplied by it self produceth that Square Number, as 49 is a Square Number whose Side is 7, for 7 times 7 is 49; and in the Table annexed all the Squares of the Digits to 9 are set down. But if the Number exceed, then the Rule is, *Make a Point over the last Figure, or Unit-place, and so of each other, the Number of those Points shews how many Places of Figures are to be the Quotient or Root:* As in the Example.

Roots.	*Squares.*	*Cubes.*
1	1	1
2	4	8
3	9	27
4	16	64
5	25	125
6	36	216
7	49	343
8	64	512
9	81	729

Go to the first Point on the left hand, which is 10; seek in the Table the next less Square, which is 9, and the Root set in the Quotient, which is 3; set 9 under 10, and subtract, rests 1, after which adding the two next Figures makes it 160: Now double the Quotient 3, and it makes 6, which set before 160 for a Divisor, and work as in Division; only note, that the Divisor when multiplied must not reach by one place so far as the Remainder; so 6 will be in 16 twice, I set 2 in the Quotient, and multiply it by 6, and it makes 12, which set under 16; then take the Square of 2, the last Figure in the Quotient, which is 4, and setting it under 0, makes in all 124, which subtracting leaves 36. Double the Quotient 32, and it makes 64 for the new Divisor, (which is every time to be repeated) which will be found five times in 361: Work as before, and as in Division, and the Root will be found 3256.

```
      10601536 ( 3256
      9
      ---
 6)   160
      ---
      124
      -----
 64)   3615
       ----
       320
         25
       -----
 650)  39036
       -----
       3900
         36
       -----
        000
```

Rule

Rule VII.

Extraction of the Cube Root.

A *CUBE NUMBER* is such, whose Root multiplied by it self, and again the Product multiplied by the Root, produceth the Cube; as 343 is a Cube Number, whose Root is 7, for 7 times 7 is 49, and 7 times 49 is 343, and those Numbers in the former Table, under *Cubes*, are the Cubes of all the Digits to 9, and will be of use, as followeth. When any Number is given to extract the Cube Root, do thus: First point the last Figure, and every third, as in this Example; then I seek in the Table of Cubes for 146, and find 125 next less, whose Root 5 I set in the Quotient, and subtract 125 from 146 and there rests 21; after which I add 363 to the next Point: Now for a new Divisor, which must be found at each several Operation, square the Quotient, and triple that Number, as 5 times 5 is 25, and 3 times 25 is 75, which I set for a new Divisor; (and whereas in the searching for the Square Root I set all one short from the right hand, here I allow two Places;) then I enquire how many times 7 can be in 21? or how many times 75 can be in 213? and finding it twice, I set 2 in the Quotient, and multiplying it by 75 find it 150, which I set (as in the Example) two Places short of the last Figure.

```
      146363183 ( 527
      125
      ---------
  75 ) 21363
      ---------
       150..
         60.
           8
      ---------
       15608
      -----------
8112 ) 5755183
      -----------
       56784..
         7644.
          343
      -----------
       5755183
      -----------
             0
      -----------
```

Next, I square 2 the last Figure in the Quotient, which makes 4, and multiply that by the Triple of the former Figure, that is, 3 times 5 makes 15, and 4 times 15 is 60, which I set one Place further on to the right hand, as in the Example. Lastly, I cube 2, which is 8, as you may see in the little Table, and set it still one Place further, under the Figure 3: Then I add those three Sums, and find the Product 15608, which I subtract from 21363, and there rests 5755, to which I annex the next three Figures, and make it 5755183. And this Work must be repeated for each several Figure in the Quotient. The next Divisor will be found to be 8112; by squaring 52, or multiplying 52 by 52, it makes 2704, which tripled is 8112, and the Work will stand (by repeating the same operation) as in the Example, where 7 times 8112, which is 56784, is set two Places short; then square 7, which is 49, and multiply that by 156, which is the Triple of 52, it makes 7644, which I set one Place further; and lastly I cube 7, which is 343, and set it to the last, and adding them together they make 5755183, which taken from the last Remainder leaves nothing. So the Root is 527. If after all these there remain any Figures, what to do in that case shall be shewed hereafter.

These

These *Rules* thus perfectly gotten, the rest of the Work, through all the Parts of *Arithmetick*, will be pleasant and easie to the Learner; wherefore if this be had, which but a little pains may obtain, we may proceed to the rest.

SECTION II.

Of Weights, Measures, Coyn, and Time.

§. 1. *Long Measures.*

Long Measures.

MEASURES are of Application or Reception; those of Application or Length are taken from the Parts of the Body; but in *England* they are taken from the Standard of a Yard kept in *Guildhall, London*, the third part whereof is a Foot, and the Thirty sixth part an Inch, expressed in the following Table, from One Inch to a Mile.

This Section of Measures, Weights, &c. will be of great use to be understood and known.

Inch.											
3	*Palm.*										
9	3	*Span.*									
12	4	1 ⅓	*Foot.*								
18	6	2	1 ½	*Cubit.*							
36	12	4	3	2	*Yard.*						
45	15	5	3 ¾	2 ½	1 ¼	*Ell.*					
60	20	6 ⅔	5	3 ⅓	1 ⅔	1 ¼	*Pace.*				
72	24	8	6	4	2	1 ¾	1 ⅕	*Fathom.*			
198	66	22	16 ½	11	5 ½	4 ⅖	3 ⅒	2 ¾	*Pole.*		
7920	2640	880	660	440	220	176	132	110	40	*Furlong.*	
63360	21120	7040	5280	3520	1760	1408	1056	880	320	8	*Mile.*

This Table of *Long Measures* (as all the rest after) may be considered as to the Columns from top to bottom, or by and betwixt the Lines from left hand to right: Each Column has its Name at the top, as in the first of Inches, all the Numbers, *viz.* 3, 9, 12, 18, 36, &c. are to be accompted Inches; but the Numbers between the Lines have respect to the Name at

C the

the end againſt which they ſtand, as 36 Inches, 12 Palms, 4 Spans, 3 Feet, and 2 Cubits, make ſeverally a Yard; and ſo at the bottom you have the Inches, Palms, Spans, Feet, Cubits, Yards, Ells, Paces, Fathoms, Poles, and Furlongs in a Mile.

In this Table it is ſaid, that a Pole or Perch for meaſuring Land is 16½ Feet, which is according to the Statute, but there are other Cuſtomary Poles or Perches, as 18 Feet for Fens and Wood-land, 21 Feet for Forreſts, *Lancaſhire*, and *Ireland*, and 18¾ for *Scotch* Meaſure.

The Meaſure for the Height of Horſes is by Handfuls, *viz.* 4 Inches.

The Ell by the Table is 5 Quarters of a Yard, and contains 20 Nails, as a Yard does 16; therefore the fifth part of an Ell is a Quarter of a Yard. A *Dutch* or *Flemiſh* Ell or Stick is three Quarters of a Yard, by which Tapiſtry is meaſured.

§ 2. *Square Meaſure.*

Square Meaſure.

SQUARE MEASURES, or *Superficial*, are contained in this ſmall Table.

Inches ſquare.							
144	*Feet ſq.*						
1296	9	*Yards ſq.*					
3600	25	2.77	*Paces ſq.*				
39204	272.25	30.25	10.89	*Poles ſq.*			
1568160	10890	1210	435.6	40	*Roods ſq.*		
	43560	4840	1742.4	.160	4	*Acres ſq.*	
		3097600	1115136	102400	2560	640	*Miles ſq.*

By reading of which Table, the Columns are Square Inches, Feet, Yards, &c. and the Lines, ſuppoſe againſt Acres, are read thus: 43560 ſquare Feet, 4840 ſquare Yards, 1742.4 ſquare Paces, 160 Pole, and 4 Roods, or any of them, make one Acre.

§ 3. *Solid Meaſure.*

Solid Meaſure.

SOLID MEASURE, or a Cubick Foot, contains 1728 Cubick Inches. A Cubick Yard is 27 Cubick Feet, and 46656 Cubick Inches. A Statute-Brick is 9 Inches long, 4½ Inches broad, and 2¼ Inches thick.

A Cord of Wood is 4 Feet over, 4 Feet deep, and 8 Feet long, which makes 128 Cubick Feet.

A Stack of Wood is 3 Feet over, 3 Feet deep, and 12 Feet long, which makes 108 Solid Feet.

Great Log-Wood is ſold by the Cord, and Small-Wood by the Stack.

Fifty Feet of Timber make a Load, 40 Feet a Tun; 18 Feet ſquare and one Foot deep, or 324 Feet ſolid, is a Floor of Earth; as 27 ſolid Feet is a Yard.

300 Feet of 2 Inch Plank, 200 Feet of 3 Inch Plank, 150 Feet of 4 Inch Plank, 400 Feet of 1½ Inch, and 600 Feet of Inch Plank, make a Load of Plank.

Now I ſhould acquaint you with *Hollow Meaſures*, or of *Capacity*; but becauſe moſt of them depend upon *Troy* or *Averdupois* Weights, I will explain them firſt, and then the other.

§ 4. *Troy Weight.*

Troy Weight.

TROY WEIGHT weigheth Gold, Silver, Jewels, Amber, Electuaries, Bread Corn, Liquors, &c. and from this Weight all Meaſures of Wet and Dry Commodities are taken.

The Pound *Troy* is divided into 12 Ounces, the Ounce into 20 Penyweight, and that into 24 Grains, as by the firſt Table appears.

Grains.		*Troy Weight.*	
24	*Peny-weight.*		
480	20	*Ounces.*	
5760	240	12	*Pound.*

Grains.		*Apothecaries Weight.*		
20	℈ *Scruple.*			
60	3	ʒ *Drams.*		
480	24	8	℥ *Ounces.*	
5700	288	96	12	℔ *Pound.*

Apothecaries make up their Medicines by the laſt Table of *Troy* Weight, but buy and ſell Drugs by the *Averdupois*.

§ 5. *Averdupois Weight.*

Averdupois Weight.

BY AVERDUPOIS WEIGHT are weighed all Phyſical Drugs, Grocery, Roſin, Wax, Pitch, Tar, Tallow, Soap, Hemp, and all things that have waſte, all baſe Metals and Minerals, as Iron, Steel, Lead, Tin, Copper, Alom, Copperas, &c.

The Pound *Averdupois* is divided into 16 Ounces, an Ounce into 8 Drams, a Dram into 3 Scruples, and a Scruple into 20 Grains.

Scruples.		*Averdupois Weight.*			
3	*Drams.*				
24	8	*Ounces.*			
384	128	16	*Pounds.*		
43008	14336	1792	112	*Hundreds.*	
860160	286720	35840	2240	20	*Tun.*

Great Hundred.

Now 112 lb. make a C. or Hundred-weight, or the great Hundred, and 20 C. make a Tun, which is ſhewed in the laſt Table.

Eighty Ounces *Averdupois* make near to 73 Ounces *Troy*: But Dr. *Wiberd* makes 14 Pound *Averdupois* equal to 17 Pound *Troy*; therefore let *Troy* Pound to *Averdupois* be as 17 to 14, *Troy* Ounces to *Averdupois* as 51 to 56.

The Hundred-weight being 112 lb. is divided into Quarters, each 28 lb. and Stones, each 14 lb. By which are weighed Iron, Guns, Shot, &c.

Variation of the Tun and Hundred.

Tun and Hundred's Variation.

Nineteen Hundred and an half is a Tun, or Fodder of Lead. Alom, Cinnamon, Nutmegs, Pepper, and Sugar, have 13 ½ Pound to the Stone, and 108 Pound to the Hundred. *Eſſex* Cheeſe and Butter has 8 Pound to the Clove, the Wey 32 Cloves, or 256 Pound. In *Suffolk* the Clove is 8 Pound, the Wey 42 Cloves, or 360 Pound; 56 Pound of Butter, 60 Pound of Soap make a Firkin, and 4 Firkins a Barrel of each.

Hay has 18 Hundred, 36 Truſſes, or 2016 Pound, to the Load or Tun.

Wool is ſold by the Clove of half Stone 7 Pound, 14 Pound the Stone, and 28 Pound the Tod; the Wey 182 Pound, and the Sack 364 Pound; the Laſt 4368 Pound.

A Faggot of Steel is 120 Pound. A Burthen of Gad Steel is 9 Score or 180 Pound. Butchers account 8 Pound to the Stone. A Laſt of Powder is 24 Barrels.

To weigh much with a few Weights, note, That 1 Pound, 3 Pound, and 9 Pound, will weigh all from 1 to 13 Pound; and 1, 3, 9, 27 Pound, will weigh all to 40 Pound; and 1, 3, 9, 27, and 81 Pound, will weigh all to 121 Pound.

And note, it will be uſeful to obſerve, That a Veſſel which is 12 Inches ſquare, and 12 Inches deep, that is, a *Cubick Foot*, will hold 76 lb. *Troy*, and 62.588 lb. *Averdupois*; and therefore 1 lb. *Troy* will fill 22.737 Solid Inches, and 1 lb. *Averdupois* 27.609 Solid Inches.

Having thus ſtated the buſineſs for Weights, I come now to Meaſures of Capacity, which are either Dry Meaſures or Wet.

§. 6. *Dry Meaſures.*

Dry Meaſures.

DRY MEASURES of *Capacity*, are raiſed from the Gallon, containing 8 Pints, which ſhould be contained in 272 ¼ Cubick Inches, and ſhould hold of pure Running or Rain Water 9 Pound, 13 Ounces, 12 Drams and ½, *Averdupois* Weight. Therefore to obtain a true Gallon for Dry Meaſure, if you make a Veſſel Cubick, that ſhall have all the Sides 6 Inches and 48 hundred Parts of an Inch ſquare, and juſt ſo deep; or if you weigh with *Averdupois* Weights 9 Pound, 13 Ounces, and 12 Drams and ½, of clean Rain or Running Water; either of theſe will find out the Gallon for Dry Meaſure.

The

The Table following ſhews 8 Pints to be a Gallon, 2 Gallons a Peck, 4 Pecks to a Buſhel, 2 Buſhels to a Strike, 2 Strikes or 4 Buſhels to Coom or Canock, 2 Coom to a Quarter, Seam or Roſer, 6 Quarter to a Wey.

This Table is for meaſuring Corn, and the two laſt Lines contain the eſtimated Weights, the firſt *Troy*, the laſt *Averdupois*, that each ſeveral Quantity contains.

	Pints.									
	8	*Gallons.*								
	16	2	*Pecks.*							
	64	8	4	*Buſhels.*						
	128	16	8	2	*Strikes.*					
	256	32	16	4	2	*Carnock or Coom.*				
	512	64	32	8	4	2	*Seam or Quarter.*			
	3072	384	102	48	24	12	6	*Wey.*		
	5120	640	320	80	40	20	10	12	*Laſt.*	
A	1 lb.	8 lb.	16	64	128	256	512	3072	5120	Troy.
B	14 ℥	7 lb.	14	56	1 C.	2 C.	4 C.	24 C.	40 C.	Aver.

Some make 6 Quarters of Meal a Wey, and 1 Wey and ¼ to a Laſt.

Meal is weighed as Corn, but the common repute is, that a Gallon of Wheaten Meal weighs 7 Pound *Averdupois*, and 8 Pound, 6 Ounces, 4 Peny-weight, *Troy*; and ſo a Buſhel 56 Pound *Averdupois*, and 68 Pound, 1 Ounce, 12 Peny-weight, *Troy*. All other Grain, Salt, Lime, Coals, &c. follow the *Wincheſter* Meaſure; though Sea Coal and Salt be meaſured by this Buſhel, yet it is heap'd, or elſe 5 ſtricken Pecks are allowed to the Buſhel called *Water-Meaſure*; 36 Buſhels are a Chaldron of Coals, and on Ship-board 21 go to the Score; 3 Buſhels make a Sack, 4 ½ ſuch Buſhels a Fat or Flat, 12 Sacks make 4 Fats. Of Salt 40 Buſhels make a Wey.

§. 7. *Liquid Meaſures.*

Liquid Meaſures.

LIQUID MEASURE is either of Wine, Ale, or Beer. The Wine Gallon contains 231 Cubical Inches, and ſhould hold of pure Rain or Running Water 8 Pound, 1 Ounce, 11 Drams, *Averdupois*; or 9 Pound, 10 Ounces, 1 ¼ Peny-weight, *Troy*; or a Cubick Veſſel of 6 Inches and 13 hundred Parts every way: Either of theſe will find out this Gallon. A Tun of Wine weighs 17 Hundred Weight *Averdupois*.

A Table

Wine, Honey, Oyl, &c. Measure.

A Table for Wine Measure, Honey, Oyl, &c.

Pints.								
8	*Gallons.*							
144	18	*Rundlets.*						
252	31 ½	1 ¾	*Barrels.*					
336	42	2 ⅓	1 ⅓	*Terces.*				
504	63	3 ½	2	1 ½	*Hogsheads.*			
672	84	4 ⅖	2 ⅔	2	1 ⅓	*Puncheons.*		
1008	126	7	4	3	2	1 ½	*But or Pipe.*	
2016	252	14	8	6	4	3	2	*Tun.*

The Gallon for Ale and Beer holds 282 Solid Inches, and weighs of pure Water 10 Pound, 3 Ounces, .426 hundred Parts, *Averdupois*; therefore the Cubick Vessel ought to be 6 Inches, and 55 hundred Parts of an Inch each way, to find this Gallon. In a Solid Foot are 1728 Solid Inches, which make 6.128 Gallons; and in a Hogshead are 10 Feet Solid, and 287 Parts, and taking the round Sum 10 Feet to be in a Hogshead, there will be 20 Feet in a But or Pipe, and 40 Feet in a Tun.

Beer and Ale Measure.

Beer Measure.

Pints.				
8	*Gallons.*			
72	9	*Firkins.*		
144	18	2	*Kilderkins.*	
288	36	4	2	*Barrels.*
576	72	8	4	2 *Hogshead.*

Ale Measure

Pints.				
8	*Gallons.*			
64	9	*Firkins.*		
128	18	2	*Kilderkins.*	
256	36	4	2	*Barrels.*
512	72	8	4	2 *Hogshead.*

Note, That Vessels for Butter, Fish, Soap, follow the Ale Measure of a Gallon, and that 12 Ale Barrels make a Last. The Tare for the Cask of Butter, Soap, is 6 ½ Pound for a Firkin, 13 Pound for the Kilderkin, and 26 Pound for the Barrel.

§. 8. *Tale of several Goods.*

Tale of several Goods.

THe *TALES* of several *Goods* will be worth knowing, either at home or abroad.

120 Ells of Canvas Cloth make an Hundred, 14 Ells of Fustian make a Chese, and 10 Ells of fine Linnen, Silk, and Sindon, the same.

Cod Fish, Haberdine, Ling, *&c.* have 124 to the Hundred, and 1240 to the Thousand. Eels, 25 to the Stick, and 10 Sticks to the Bind. Of Herrings and Stock Fish, 120 to the Hundred, 1200 to the Thousand laid in a Barrel, and 12 Barrels to the Last.

Deals

Deals and Nails are for the most part sold 120 to the Hundred.

Of Furs; Filches, Grays, Jennets, Martins, Sables, Minks, 40 Skins make a Timber; other Skins, 5 Score to the Hundred.

A Seam of Glass is 24 Stone, or 120 Pound.

A Bale of Paper is 10 Ream, a Ream 20 Quire, a Quire 25 Sheets of some, and 24 of others.

A Roll of Parchment is 5 Dozen, a Dozen is 12 Skins.

Twelve Dozen make a Gross.

Ten Hides are a Dicker, 20 Dickers a Last.

Ten Pair of Gloves make a Dicker, and so do 10 Horse-shooes.

Great Skins are numbred by the Kip, of 50 Skins to the Kip.

Laths 5 Foot long have 5 Score to the Hundred, 4 Foot long 120 to the Hundred. All Laths ought to be 1 ½ Inch broad, and ½ Inch thick.

Five Hundred Bricks make a Load, and so does 100 Plain Tiles.

Of Bread, 13 goes to the Dozen, and 21 Dozen to the Score.

Five Foot of *Newcastle* Glass make a Table, and 45 Tables make a Case; but of *Normandy* Glass, 25 Tables make a Case.

In the City, Lime is sold by the Bag, each Bag holds a Bushel, and 25 such Bags make an Hundred. Some Places have 40 Bushels to the Load.

70 Pipe Hoops, 90 Hogshead Hoops, 120 Barrel or Kilderkin Hoops, or 180 Firkin Hoops, make a Bundle or Hundred.

§. 9. *Money.*

THe ACCOMPT of *MONEY* is very necessary to be known. *Money.*

English Money.

4 Farthings	make 1	Peny.
12 Pence		Shilling.
20 Shillings		Pound

	s.	*d.*
A Mark is	13	04
A Noble	6	08

Spanish Money.

6 Carnadoes	make 1	Marveid.
54 Marveids		Ryal. 6*d. Eng.*
11 Ryals		Ducat.
8 Ryals		Peece of 8. 4*s. Engl.*
4 Quartiles		Royal.

Portugal Money.

40 Res	make 1	Ryal. 6*d Eng*
2 ½ Ryals		Testoon.
4 Testoons or 10 Ryals		Ducat.
2 ½ Ducats		Milt of gold.

French Money.

12 Deniers	make 1	Soulz.
20 Soulz		Frank or Liver.
16 Soulz		Cardecu.
4 Cardecues		Crown.

Scotch Money.

1 Small Peece	make 1	2 ¼ *d. English.*
3 Small Peeces		Noble, 6 ¾ *d. Eng.*
2 Nobles		Mark, 13 ½ *d. Eng.*
3 Nobles		1*l. Scotch*, 20 *d. Eng.*

Irish

Irish Coin.

Two $4\frac{1}{2}$ *d.* is one Harper, or 9 *d. English*; and 20 Harpers is 1 *l. Irish*, or 15 *s. English*.

Flemish Coin.

8 Pence	is	1 Groat.
2 Groats		1 Single Stiver.
2 Single Stivers		1 Double Stiver, or $3\frac{1}{4}$ *d. English*.
20 Single Stivers, or 10 Double		1 Gilder.
6 Gilders		1 Pound.

§. 10. *Time.*

Time.

IN a Common-Year are 365 Days and 6 Hours, but in a Leap-Year 366. In a Day Natural are 24 Hours, in an Hour 60 Minutes, and in a Minute 60 Seconds, *&c.* In a Year are 52 Weeks, 13 equal Months of 28 Days to a Month and 1 Day, or 12 unequal Months.

The Characters used to express the former Moneys, Weights, *&c.* are they that follow.

A Pound *l.* a Shilling *s.* a Peny *d.* an Half-peny *ob.* or $\frac{3}{4}$, $\frac{2}{4}$, $\frac{1}{4}$, for 3 Farthings, an Half-peny, or Farthing. A Pound Weight ℔. an Ounce ℥, a Grain *Gr.* a Scruple ℈, a Dram ʒ, a Quarter *Qr.* a Crown △, an Hundred Weight C.

I shall now come to shew you the Practice of *Addition* and *Subtraction* in these Parts of Money, Weight, and Time, where the Denominators are omitted, which will bring to use the aforesaid Rules, and will cause you to seek for as much as you shall have need for amongst the Tables.

SECTION III.

Of the Addition, Subtraction, and Reduction of Numbers of several Denominations.

§. 1. *Addition of several Denominations.*

Addition of several Denominations.

THe Rule for *ADDITION* will be, To sum up each Denomination, and to see how many of them will make one of the next Denomination, and to bear so many Units forwards, as those will come to.

In

In this Example I begin with Pence, and say, 9 and 2 is 11, and 8 is 19, which I find to exceed 12 Pence, the Pence in a Shilling, and contain it once, and 7, which 7 I set down under Pence, and carry 1 to Shillings, saying, 1 and 5 is 6, and 1 is 7, and 7 is 14, I set down 4, and account how many 10 *s.* I have, which are 3, which make 1 *l.* 10 *s.* the 10 *s.* I set by the 4, and carry 1 to the Pounds, and adding them as in whole Numbers, I find the Sum to be 234 *l.* 14 *s.* 7 *d.*

135	17	08
95	11	02
3	05	09
234	14	07

l.	*s.*	*d.*
175	15	02 $\frac{2}{4}$
75	11	09
30	00	00
71	11	11 $\frac{2}{4}$
131	10	10
484	09	09

Troy Weight.

℔.	℥.	*Pwt.*	*Gr.*
13	09	13	15
221	11	10	01
15	10	11	02
251	07	14	18

Averdupois Weight.

Tun.	*C.*	*Qr.*	℔.	℥.
0	2	3	15	10
0	16	2	11	12
0	34	1	00	08
0	17	0	10	03
3	10	3	10	01

These three Examples will be sufficient. The first of Pounds, Shillings, and Pence, as before. The second Example of *Troy Weight*, where for every 24 Grains I carry 1 to the Peny-weight, for every 20 Peny-weight I carry 1 to the Ounces, and for every 12 Ounces 1 to the Pound, and the Sum will be 251 Pound, 7 Ounces, 14 Peny-weight, and 18 Grains. And so for *Averdupois Weight*, for every 16 Ounces I carry 1 to the Pound, for every 28 Pound I carry 1 to the Quarters, and for every 4 Quarters 1 to the Hundred, and 20 Hundred for a Tun.

All the trouble lyes in carrying so many of former Denominations as are contained in that Row you add up.

§. 2. *Subtraction of several Denominations.*

Subtraction of several Denominations.

SUBTRACTION in these Numbers, is no more, than to take the lower Denomination from the higher; which if it be lesser, and you cannot take it, then you must borrow one of the former Denominations and subtract, remembring to add 1 to the next Denomination below.

	l.	*s.*	*d.*
	375	11	05
	132	09	04
Rem.	243	02	01

l.	*s.*	*d.*
1754	11	02 $\frac{3}{4}$
982	13	05 $\frac{1}{2}$
771	17	09 $\frac{1}{4}$

Troy Weight.

℔.	℥.	*Pwt.*	*Gr.*
17	09	13	22
15	11	19	20
1	09	14	02

The first Example has no difficulty, being the lower is in each Denomination less than the higher. In the second Example, because 5 *d.* will not come out of 2 *d.* I borrow 12 *d.* and make it 14 *d.* and then 5 out of 14

rests

refts 9; now I remember to make 13, 14, reftoring the 12 *d.* I borrowed (which muft be carefully done) and fay, 14 out of 31 (borrowing 20) refts 17. Then, as in the Whole Numbers, 3 out of 4, refts 1, &c.

Note, It is an eafier way, to take the lower from what you borrowed, and add the Remainder to that above, than to work the ordinary way; as in the faid Example, fay 5 out of 12 I borrowed refts 7, and 7 and 2 is 9. Again, in Shillings, it is better to fay, 14 out of 20 refts 6, and 6 and 11 makes 17. In the third Example of *Troy Weight*, in the fecond Denomination of Peny-weight, I fay, 19 out of 20 refts 1, and 1 and 13 makes 14. Then, 12 Ounces from 12 I borrow refts o, and o and 9 is 9.

```
1678
1617
----
  61
```

Here the young Scholar will receive fome encouragement; for if I demand of him this prefent year 1678, what Age I was, being born 1617? let him fubtract the leffer Number 1617 from the greater 1678, and there refts 61 Years.

	l.	*s.*	*d.*
Received	30	00	00
More	50	00	00
More	62	11	06
Sum of Receipts	142	11	06
Disburs'd	7	15	07 ½
More	34	18	09
More	18	17	05
More	23	11	08 ½
More	32	09	08 ¼
Sums disburs'd	117	13	02 ¼
Remains	24	18	03 ¾
Proof	142	11	06

Here he may fum up the Receipts and Payments of the feveral Pages of his Accompts, and fee what the Ballance may be, as in the Example; where the feveral Pages of the Receipts, *viz.* 30 *l.* 50 *l.* and 62 *l.* 11 *s.* 6 *d.* comes in all unto 142 *l.* 11 *s.* 6 *d.* And the Pages of the feveral Disburfements, (1.) 7 *l.* 15 *s.* 7 ½ *d.* (2.) 34 *l.* 18 *s.* 9 *d.* (3.) 18 *l.* 17 *s.* 5 *d.* (4.) 23 *l.* 11 *s.* 8 ½ *d.* and (5.) 32 *l.* 9 *s.* 8 ¼ *d.* amount in the whole to 117 *l.* 13 *s.* 2 ¼ *d.* which being taken out of the former Receipts, there refts 24 *l.* 18 *s.* 3 ¾ *d.* And for Proof, this Remainder and the Disburfements being added together, make the Sum of the Receipts, as you may fee in the Example.

§. 3. *Reduction.*

Reduction.

THe next is, to fhew how any of thefe Numbers, whether of Money, Weight, Meafure, &c. may be brought from the higheft or higher Term to the loweft or lower; which to do, you muft confider how many of the next leffer Denomination is contained in the next greater before, and by that Number multiply the greater; as Pounds are brought into Shillings by multiplying by 20, Shillings into Pence by 12, and Pence into Farthings by 4; as in the following Examples, where 27 *l.* 19 *s.* 5 *d.* make 6713 *d.* and 13 *l.* 15 *s.* 6 ¾ *d.* make 13227 *f.* And here I multiply by 12 at once.


```
 l.    s.     d.              l.    s.     d.      f.
 27 |  19 |    5              13 |  15 |  6 ¾ |
 20 | 540 | 6713              20 | 260 | 3306 |
    | 559 |                      | 275 |    4 | 13227
    |  12 |                      |  12 |      |
```

Troy Weight may be reduced into Grains, by multiplying by 12, 20, and 24: And *Averdupois Great Weight* into Ounces, by 4, 28, and 16. 352 Pound *Troy Weight* makes 2027520 Grains.

```
Lib.     ℥.      Pwt.          Lib.  ℥.    Pwt.    Grains.
 352    4224     84480          37 |  10 |   16 |      11
  12      20        24          12 | 444 | 9080 |   36384
----   -----    ------             |     |      |   18192
4224   84480    337920             | 454 | 9096 |  ------
               168960              |  20 |   24 |  218315
               -------
               2027520
```

And fo of any higher to a lower by Multiplication; but if it be to bring the lower to a higher, then divide the leaft by fo many of its Denominations as are contained in the next greater. Example, to bring 42720 Pence into Pounds, Shillings, and Pence; the Anfwer is 178 Pound: And if any had remained in either Divifion, they had been the odd Pence and Shillings; as in the fecond Example, in 6713 *d.* there is 27 *l.* 19 *s.* 5 *d.*

Note, That to reduce Shillings into Pounds, is to cut off the laft Figure, and take half of the reft, as the half of 5 is 2, of 15 is 7, and there remains 19 *s.* and 5 *d.*

```
       d.        s.      l.                        l.   s.   d.
12 ) 42720 ( 356|0 ( 178          12 ) 6713 ( 55|9 ( 27 : 19 : 05
     36                                60
     --                                --
     67      2)                        71      2)
     60                                60
     --                                ---
     72                                113
     72                                108
     --                                ---
      0                                  5 d.
```

After the fame manner may *Troy* Weight, *Averdupois*, or any other Weight or Meafure, be reduced.

Likewife Foreign Coin may be reduced into *Englifh*, by turning the Value into

into *English* Coin of any part: As, What is the Value of 223 *Scotch* Mark, equal to $13\frac{1}{2}$ *d.* *English?* which is 54 Farthings, and 223 by 54 makes 12042 Farthings, which reduced backwards to Pounds, Shillings, Pence, makes 12 *l.* 10 *s.* $10\frac{1}{2}$ *d.*

SECTION IV.

Of FRACTIONS, *whose* Species *and Rules shall be brought into as short a Form as may be.*

Of Fractions.

A *Broken* Number, called a *FRACTION*, denotes or signifies one or more Parts proportionably of any thing divided: It consists of two Numbers, the *higher* and *lower*, with a Line betwixt them. The higher is the Remainder after Division, the lower is the Divisor; the higher numbers the Parts of the Thing divided remaining after Division, and is called the *Numerator*; the lower denominates the Parts, and is called the *Denominator*.

This Knowledge consists in the *Reading* of a Fraction, in the *Abbreviation*, *Estimation*, and *Reduction*; and lastly, in the performing the ordinary Rules of *Addition, Subtraction, Multiplication, Division*, and in *Extracting* the Roots. Every one of which shall follow in order.

§. 1. *Pronunciation.*

Reading of a Fraction.

THe *READING* pronounceth the higher first, then the lower, as $\frac{3}{4}$, called *three fourths*; so $\frac{1}{2}$, $\frac{1}{3}$, $\frac{5}{7}$, $\frac{32}{150}$, are called, the *half*, the *third part*, the *five seven parts*, the 32 *parts of* 150.

§. 2. *Abbreviation of a Fraction.*

Abbreviation of a Fraction.

THe *ABBREVIATION* is, when both the Numerator and Denominator, divided by some *Common Measure*, are exprest in lower Terms, as $\frac{4}{8}$ being divided by 4, the greatest Common Measure, gives $\frac{1}{2}$, the same in value; for as 4 is the half of 8 (supposing of an Inch divided into 8) so is 1 of 2, &c.

How to find this *Greatest Common Measure*, the Rule is, *Divide the Denominator by the Numerator, or the greater by the less, and the Divisor by the Remainder, and the first of the Divisors, that divideth the Dividend without a Remainder, is the Greatest Common Measure.* Thus in $\frac{24}{38}$, 2 is found the Greatest Measure, and will bring $\frac{24}{38}$ to $\frac{12}{19}$ by dividing by 2.

```
24) 38 (1    14) 24 (1    10) 14 (1    4) 10 (2    2) 4 (2
    24           14           10           8          4
    --           --           --          --          -
    14           10            4           2          0
```

Thus

Thus all Fractions ought to be abbreviated before you work them, as $\frac{36}{54}$ by 18 becomes $\frac{2}{3}$, so $\frac{432}{728}$ by 8 becomes $\frac{54}{91}$, being of the same value as before. But if the last Remain in finding the Common Measure be 1, then those Numbers are incommensurable, and are in their least Terms already. If both the Terms have Cyphers to the right hand, cut them off, so $\frac{20}{30}$ becomes $\frac{2}{3}$. Even Numbers may be brought down by halving, or dividing them by some commonly known Measure.

§. 3. *The Value of a Fraction.*

Value of a Fraction.

THe *ESTIMATION* or *VALUE* of a *Fraction* is known thus: If the Numerator be equal to the Denominator, then is the Fraction equal to Unity, or one Whole. But if the Numerator be less, then the Fraction is less than 1; if greater, greater: $\frac{4}{4}$ is equal to 1, $\frac{1}{4}$ is less than 1, but $\frac{6}{4}$ is 1 and $\frac{1}{2}$. If you desire to know the Value of a Fraction in some other Denomination than his own, as, What is the 5 Twelfths of a Crown? Here $\frac{5}{12}$, which has 12 for the Denominator, is to be changed into a Denominator that has 60, for so many Pence are in a Crown. Multiply the Numerator in the new Denominator, and divide by the old Denominator, and you have the Value. So 60 into 5 is 300, which divided by 12 gives 25, which signifies that 25 Pence is the $\frac{5}{12}$ of a Crown. And so the $\frac{3}{4}$ of a Day will be found 18 Hours. And so of any other.

§. 4. *Reduction of Fractions.*

Reduction of Fractions.

FIrst to reduce two Fractions of divers *Denominations* to one and the same, (having brought them first to their least Terms) multiply the Denominators together for a new Denominator, and multiply cross, the Denominator of one by the Numerator of the other, for new Numerators.

Example.

$\frac{3}{5}$ and $\frac{4}{7}$ reduced to the same Denomination becomes $\frac{21}{35}$ and $\frac{20}{35}$.

```
21   20
--------
 3    4
 5    7
--------
   35
```

And if there be more Fractions than two, to be reduced to one and the same Denomination, multiply all the Denominators for a new one, and each Numerator into all the Denominators but his own.

Thus $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{4}{5}$, if reduced to one Denomination, becomes $\frac{60}{120}$, $\frac{80}{120}$, $\frac{90}{120}$, $\frac{96}{120}$, and reduced by halving will be $\frac{30}{60}$, $\frac{40}{60}$, $\frac{45}{60}$, $\frac{48}{60}$.

```
60   80   90   96
-----------------
 1    2    3    4
 2    3    4    5
-----------------
       120
```

To reduce a Whole Number into an improper Fraction of a Denomination given, multiply that Number by the Denominator given, and set it

over

over it Fraction-wise, as to reduce 7 to a Denominator of 4, it will be $\frac{28}{4}$; and to reduce 5 into $\frac{3}{3}$, it will be $\frac{15}{3}$: And thus any Whole Number and Parts are to be handled; as $3\frac{2}{5}$ makes $\frac{17}{5}$: So likewise an improper Fraction, where the Numerator is equal or greater than the Denominator, is to be brought into Whole Numbers, by dividing the Numerator by the Denominator. Thus $\frac{10}{2}$ will be 5, and $\frac{28}{5}$ will be $5\frac{3}{5}$, and $\frac{17}{5}$ will be $3\frac{2}{5}$.

§. 5. *Fractions of Fractions.*

Fractions of Fractions.

THus far has concerned Fractions pure, that are only Parts of the Whole; there are yet such as are called *Fractions of Fractions*, or *Particulars*, which are Parts of a Fraction, as $\frac{1}{2}$ of $\frac{3}{4}$, or $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{1}{2}$; or, what is the $\frac{1}{3}$ of the $\frac{1}{2}$ of a Shilling? Here the half of a Shilling, which is 6 *d.* is supposed to be divided into 3, and so the $\frac{1}{3}$ will be 2 *d.*

To know these Fractions from other, it is usual to make a Comma after them; and to reduce them to one Denomination, so as they may be wrought with other Fractions, is to multiply all the Denominators together for a new Denominator, and all the Numerators together for a new Numerator.

Thus $\dfrac{\overline{\;252\;}}{\underline{\frac{3}{4},\frac{2}{3},\frac{6}{7},\frac{7}{9}}}$ will make $\frac{252}{756}$, abbreviated will be $\frac{1}{3}$, by dividing all
$\;\;756$
by 252 the Common Measure.

§. 6. *Addition and Subtraction of Fractions.*

Addition and Subtraction of Fractions.

ADdition and *Subtraction* of *Fractions* (after they be abbreviated and reduced as is before shewed) consists in the adding and subtracting the Numerators to or from one another. And this falls out either to be Fractions with Fractions, Whole Numbers with Fractions, or Mixt with Fractions, or Mixt with Mixt.

	Addition.	*Subtraction.*
Fractions.	$\frac{2}{5}$ $\frac{1}{5}$ make $\frac{3}{5}$. $\frac{48}{60}$ $\frac{12}{60}$ make $\frac{60}{60}$, or 1.	$\frac{2}{5}$ less by $\frac{1}{5}$ make $\frac{1}{5}$. $\frac{48}{60}$ less by $\frac{12}{60}$ make $\frac{36}{60}$.
Numbers & Fractions.	5 and $\frac{2}{3}$ to be added is $\frac{17}{3}$.	Out of 5 take $\frac{2}{3}$, rests $4\frac{1}{3}$.
Whole Numbers and Mixt.	7 and $4\frac{2}{3}$ added would be $11\frac{2}{3}$.	Subtracted will be $\frac{21}{3}-\frac{14}{3}=\frac{7}{3}$.
Mixt with Mixt.	$5\frac{4}{9}$ added to $4\frac{3}{9}$ makes 9 and $\frac{7}{9}$.	Subtracted is $1\frac{1}{9}$.
Unlike Denomination.	$4\frac{2}{3}$ and $2\frac{3}{4}$ added makes $6\frac{17}{12}$.	Subtracted is $1\frac{11}{12}$.

The

The Work for *Addition*, $\dfrac{\overset{8}{\overline{4,\frac{2}{3}}}\quad\overset{9}{\overline{2,\frac{3}{4}}}}{12}$ For *Subtr.* $3\frac{20}{12}$ less by $2\frac{9}{12}$ make $1\frac{11}{12}$.

So to add $6\frac{3}{4}$ to $10\frac{1}{2}$, and to $14\frac{5}{6}$, I reduce the Fractions as before, then it will be $6\frac{18}{24}$, $10\frac{12}{24}$, $14\frac{20}{24}$, which will make, if added together, $30\frac{50}{24}$, or $32\frac{2}{24}$, or $32\frac{1}{12}$.

So to subtract $4\frac{3}{4}$ from $6\frac{2}{3}$, that is reduced $5\frac{20}{12}$, less by $4\frac{9}{12}$, rests $1\frac{11}{12}$.

§. 7. *Multiplication of Fractions.*

Multiplication of Fractions.

MAke Mixt Numbers improper Fractions (first having brought them down by Abbreviation) and make Whole Numbers like Fractions, by placing an Unit under them. Then the Rule for *Multiplication* is, *Multiply the Numerators together for a new Numerator, and the Denominators for a new Denominator.*

$\frac{3}{5}$ by $\frac{2}{3}$ make $\frac{6}{15}$ or $\frac{2}{5}$. $2\frac{2}{5}$ by $3\frac{7}{8}$, or $\frac{12}{5}$ by $\frac{31}{8}$, make $\frac{372}{40}$ or $\frac{93}{10}$.
6 by $3\frac{2}{3}$, or $\frac{6}{1}$ by $\frac{11}{3}$, make $\frac{66}{3}$, or $\frac{22}{1}$, or 22.

If the cross Terms can be abbreviated, do it, as in this Example.

$\frac{2}{5}$ by $\frac{1}{4}$ abbreviated cross will be $\frac{1}{5}$ by $\frac{1}{2}$ makes $\frac{1}{7}$.

§. 8. *Division of Fractions.*

Division of Fractions.

FOr *Division* the Rule is, *Multiply alternately the Numerator of the Dividend by the Denominator of the Divisor for a new Numerator, and the other Numerator and Denominator for a new Denominator.*

$\frac{5}{7})\ \frac{2}{3}\ (\frac{14}{15}$ $\qquad 2\frac{4}{5})\ \frac{2}{3}\ ($ $\qquad$ or $\frac{14}{5})\ \frac{2}{3}\ (\frac{10}{42}$ or $\frac{5}{21}$

If one Fraction be divided by another, the Quotient shews the Proportion which one bears to another, by which you may know the greater. Thus, $\frac{2}{3})\ \frac{6}{9}\ (\frac{18}{18}$, $\frac{2}{3}$ is equal to $\frac{6}{9}$, but $\frac{3}{4}$ is greater than $\frac{3}{12}$, for $\frac{3}{12})\ \frac{3}{4}\ (\frac{36}{12}$; and $\frac{2}{3}$ is less than $\frac{3}{4}$, because $\frac{3}{4})\ \frac{2}{3}\ (\frac{8}{9}$.

Here note, That to multiply any of the Parts of Money, Weight, &c. by reducing all into the least Terms will be erroneous, as 2 *l.* 19 *s.* $11\frac{3}{4}$ *d.* multiplied by it self, reduced to 2879 Farthings, will be 8633 *l.* 1 *s.* $8\frac{1}{4}$ *d.* because the Denominator 960 is omitted, which ought in this case to be restored to it as a Fraction.

SECT.

SECTION V.

Of Decimal Arithmetick.

Decimal Arithmetick.

I Come now to that Part called *DECIMAL ARITHMETICK*, which is no other, but a more easie kind of *Fractions*; and if all the Accompts of Money, Weight, Measure, &c. were divided and subdivided into Tens, then all the former Rules of Fractions might be saved: As in some sort of Coin at *Rome*, consisting in Ducats, Julio's, and Baiocca's; a Ducat is the Integer, and is divided into Ten Julio's, and each Julio into Ten Baiocca's; so that to express 35 Ducats, 8 Julio's, and 7 Baiocca's, you may write them thus, 35.87, which is 35 Ducats, $\frac{8}{10}$ and $\frac{7}{100}$ of a Ducat or $\frac{7}{10}$ of a Julio. Therefore in every Decimal Fraction a Point or other Mark must follow Unity. Then, as in Integers Figures of the same kind increase in a Decimal Proportion towards the left hand, so here it is Ten times less towards the right.

§. 1. *Addition and Subtraction in Decimals.*

Addition and Subtraction in Decimals.

ADdition and *Subtraction* in *Decimals* is the same with Whole Numbers: Regarding and absolutely requiring, that Units be set under Units, and the respective Figures under the same estimation with those above them; for Cyphers before Integers or after Decimals signifie nothing, but after Integers and before Decimals retain their Value.

Addition.

```
   35.5        37.82
  342.61      572.119
 2376.723     327.9
  111.15       15.826
 --------    --------
 2865.983     953.665
```

Subtraction.

```
      32.
       0.38
      -----
      31.62

 58.72          157.1
 19.37           32.578
 -----          -------
 39.35          124.522
```

§. 2. *Multiplication in Decimals.*

Multiplication in Decimals.

WHether the Number be a Whole Number, Decimal, or Mixt with Mixt, or otherwise, the *Multiplication* is performed as in Whole Numbers; only that after the Product is found, to know how many of them are Whole, and how many are Decimals, you must separate the one from the other by a Point, telling how many Places of Decimals there are in Multiplicand and Multiplier, for so many there must be in the Product.

0.005


```
  0.005        0.15        12.301        0.0057
  0.03         3.21         .0021        0.0008
 -------      ------     ---------     ---------
  0.00015     0.4815     0.0258321     .00000456
```

§. 3. *Division in Decimals.*

Division in Decimals.

DIvision in *Decimals* will give the same Rule as before, if you conceive the Dividend to be the Product, and the Divisor and Quotient to be Multiplicand and Multiplier, for then it will follow from the former, That there must be as many Places of Decimals in the Divisor and Quotient as there are in the Dividend, and that being certain how many there are in the Dividend, and how many in the Divisor, you must take so many Places of Decimals in the Quotient, as with those Places in the Divisor (which are known) will make up the Number in the Dividend. So that if there be five Places of Decimals in the Dividend, and three in the Divisor, there will be two in the Quotient.

Divisor.	*Dividend.*	*Quotient.*
28.64)	774.43692 (	27.040
2864)	774.43692 (	.27040

If there be Places of Decimals in the Divisor, and none in the Dividend, add as many Cyphers to the Dividend, making them Decimals, and work as before.

5.71) 1713.00 (30   .72) 3816.00 (53

And if all the Places in the Divisor and Quotient will not amount to the Quantity of Places in the Dividend, then place as many Cyphers before the significant Figures of the Quotient, as will make up the Number.

72) 3.816 (.053   72) 0.3816 (.0053

Lastly, If after Division of any Number, there remain after all, some part, add a Cypher or Cyphers to the Dividend, and that part of the Quotient arising from these Cyphers will be Decimals.

Also if any thing remain after the Square Root, add two Cyphers; after the Cube Root, three; and the Quotient will give the Decimal Fraction.

§. 4. *Reduction of Fractions into Decimals, and contrarily,* viz.

Reduction of Fractions into Decimals.

AN Ordinary Fraction will be reduced into a Decimal of one Place, by multiplying the Numerator by 10; of two Places, by 100; of three, by 1000, &c. and dividing the Product by the Denominator. So $\frac{3}{4}$ will

E be

be $\frac{75}{100}$, or .75, by multiplying 3 by 100, which is 300, and dividing 300 by 4. So $\frac{19}{20}$, or 19 *s.* will be found .95

Fractions of Fractions must be reduced into one Ordinary Fraction, and then put into Decimals. So 2 *l.* 19 *s.* 11$\frac{3}{4}$ *d.* will be found in Decimals 2.9993; and multiplied (as before was shewed in Fractions) by it self, will produce 8.9956, which is 8 *l.* 19 *s.* 11 *d.* 3 *f.*

The Decimals for Shillings may be found by taking the half of the Number of Shillings, as of 16 *s.* is .8; of 10 *s.* .5; of 2 *s.* .1; of 15 *s.* .75; of 9 *s.* .45; of 1 *s.* .05

But it being tedious to convert the Ordinary Fractions this way, it is best to have Tables prepared and made ready for Use, of the most notable known Parts of Money, Weights, and Measures, as follow in the next Page.

The making of these Tables, or any other the like, is done by making the Integer 1, and adding Cyphers to it, and then taking Halves, Quarters, and Parts, 'till you come to the least Denomination, whereby the whole Table may be compleated. As 1 *l.* I make 1,0000; then is the $\frac{1}{2}$ or 10 *s.* .5; the $\frac{1}{4}$ or 5 *s.* .25; and the $\frac{1}{5}$ of that, or 1 *s.* .05: So having 1 *s.* 2 *s.* will be .1; 3 *s.* .15; 4 *s.* .2; and so the Table of Shillings is made: And because 12 *d.* is equal to .05, 6 *d.* will be .025; 3 *d.* .0125; and 1 *d.* .00417; which will make the Table of Pence. And after this manner all the rest are made.

The Uses of these Decimal Tables, First, are to turn any Number of Shillings, Pence, or Farthings, into Decimals: As 3 *l.* 15 *s.* 6$\frac{1}{2}$ *d.* would be in Decimals 3.7771

15 Shillings	=	.75
6 Pence	=	.025
2 Farthings	=	.0021
		.7771

I seek 15 *s.* against which is .75, then 6 *d.* .025, then 2 *f.* is .0021, which added is .7771

So for *Averdupois* Little Weight, 6 Pound, 12$\frac{1}{2}$ Ounces, will be 6.78125: So 3 Months and 6 Days will be .2664, *&c.*

The second Use is to turn any Number of Decimals into the known Parts of what they represent, whether Money, *&c.*

Example, 3.7771 signifies 3 *l.* 15 *s.* 6$\frac{1}{2}$ *d.* By first seeking the greatest Number next to .77, which is .75, for 15 *s.* then taking that out of .7771, leaves .0271, which amongst Pence is 6 *d.* and leaves .0021, which amongst Farthings is 2 *f.*

So in *Averdupois* Small Weight, 32.5786 would be 32 Pound, 9 Ounces, and 4 Drams, thus: The next less to .5786 is .5625 for 9 Ounces, and there remains .0261, which will be found 4 Drams.

DECIMAL TABLES.

Table I.
English Coin, 1 l. Integer.

Pence	Dec. Parts.
11	.045833
10	.041666
9	.0375
8	.033333
7	.029166
6	.025
5	.020833
4	.016666
3	.0125
2	.008333
1	.004166
Farth.	
3	.00313
2	.002083
1	.001041

Table II.
Troy Weight, Integer 1 Ounce. Peny-weight the same with Shill.

Gra.	Dec. Parts.
23	.047916
22	.045833
21	.04375
20	.041666
19	.039583
18	.0375
17	.035416
16	.033333
15	.03125
14	.029166
13	.027083
12	.025
11	.022916
10	.020833
9	.01875
8	.016666
7	.014583
6	.0125
5	.010416
4	.008333
3	.00625
2	.004166
1	.002083

Table III.
Averdupois Great Weight, Int. 1 C.

Lib.	Dec. Parts.
27	.241071
26	.232142
25	.223214
24	.214285
23	.205357
22	.196428
21	.1875
20	.178571
19	.169042
18	.160714
17	.151785
16	.142857
15	.133928
14	.125
13	.116071
12	.107142
11	.098214
10	.089285
9	.080357
8	.071428
7	.0625
6	.053571
5	.044642
4	.035714
3	.026785
2	.017857
1	.008928
Oun.	
15	.008370
14	.007812
13	.007254
12	.006696
11	.006138
10	.005580
9	.005022
8	.004464
7	.003906
6	.003348
5	.002790
4	.002232
3	.001674
2	.001116
1	.000558
Quar.	
3	.000418
2	.000279
1	.000139

Table IV.
Averdupois Little Weight, Int. 1 lib.

Oun.	Dec. Parts.
15	.9375
14	.875
13	.8125
12	.75
11	.6875
10	.625
9	.5625
8	.5
7	.4375
6	.375
5	3125
4	.25
3	.1875
2	.125
1	.0625
Dra.	
15	.058593
14	.054687
13	.050781
12	.046875
11	.042968
10	.039062
9	.035156
8	.03125
7	.027343
6	.023437
5	.019531
4	.015625
3	.011718
2	.007812
1	.003906
Quar.	
3	.002929
2	.001953
1	.000976

Table V.
Liquid Measure, Int. a Gall. or Qt.

Pints	Dec. Parts.
7	.875
6	.75
5	.625
4	.5
3	.375
2	.25
1	.125
Qter.	
3	.09375
2	.0625
1	.03125

Table VI.
Inches in Decimals, Integer 1 Foot.

Inch.	Dec. Parts.
11	.916666
10	.833333
9	.75
8	.666666
7	.583333
6	.5
5	.416666
4	.333333
3	.25
2	.166666
1	.083333
Qter.	
3	.0625
2	.041666
1	.020833
Half	.010416

Table VII.
Decimals of a Year.

Mo.	Dec. Parts.
1	.083334
2	.166667
3	.25
6	.50
9	.75
Da.	
1	.0027397
2	.0054795
3	.0082193
4	.0109591
5	.0136988
6	.0164386
7	.0191784
8	.0219182
9	.0246579

SECTION VI.

Of Logarithms, *which are Numbers, that differ Arithmetically, as the Numbers answering them differ Geometrically, and serve to ease Multiplication, Division, and Extracting the Roots, with many other Uses.*

§. 1. *To find a Logarithm.*

To find a Logarithm.

IN the first Page of the *Table of Logarithms*, Printed in the Second Part, the Logarithms answering to all Numbers under 100 are easily found, *viz.* the Logarithm of 38 is 1,579783, of 72 is 1,857332, *&c.* If the Number consist of three Places, that is, a Number under 1000, look for the Number in the Table under N, and the Logarithm is found against it in the Column under 0; so the Logarithm of 349 is 542825, of 893 is 950851. If the Number be of four Places, and under 10000, seek the three first Figures under N as aforesaid, and the last Figure on the top, under which in that Column, lineally against the first three Figures, you have the Logarithm; as for Example, the Logarithm of 3583 is 554247; finding 358 under N, against it in the Column under 3 is the Logarithm abovesaid: So the Logarithm of 4268 is 630224, of 9546 is 979821. But if the Number be above 10000, and under 100000, you will find it by the *Difference*, and the *Table of Parts Proportional*, Printed at the End of the Tables of Logarithms: Thus, if the Logarithm of 35786 be required, first seek the Logarithm of 3578, which will be 553649, and the Common Difference under D. 121; with this Difference enter the Table of Parts Proportional, and find 121 in the first Column under D. and then lineally against that Number, and under 6, the last Figure of the last Place of the Number 35786, found at the Head of the seventh Column, you will find 72, which added to the Logarithm of 3578, *viz.* 553649, makes 553721, the Logarithm of 35786.

§. 2. *Of the Indices.*

Indices.

BUt before I proceed to find Numbers answering to Logarithms, I will shew what is meant by the first Figure prefixed or to be prefixed to a Logarithm; for in the first 100 Logarithms there is a Place more than in the rest, which is by Mr. *Briggs* called the *Characteristick*, by me the ***Index***, for it shews of what nature, or how far from Unity the first Figure of any Number stands. The *Index* of Unity is 0, of Tens is 1, of Hundreds is 2, of Thousands is 3, *&c.* as in the following Example, the Index of 7 is 0, of 3 is 2, of 5 is 4, of 7 is 5, and according to this Rule, an Index must be placed to all the Logarithms in the Table.

Indices 543210
||||||
Numbers 754327

To find the Index to a Logarithm.

But if you deal with Fractions turn them into Decimals, and then for the Indices, according as their Places stand from Unity, take their Complements to 10; as if it stand next Unity take $\bar{9}$, if two Places from it take $\bar{8}$, if three $\bar{7}$, *&c.* setting a Tittle over the heads of them, so those Indices will stand quite contrary, as you will see by Examples.

10.$\bar{9}\bar{8}\bar{7}\bar{6}$
21.5782

Whence the Index of the Logarithm of 0.037 will be $\bar{8}$. Thus the Logarithm of 5784 in the Table will be found to be 762228, and the Index of the first Figure 5 being 3 as before, the Logarithm will be 3,762228.

5784	3,762228
578.4	2,762228
57.84	1,762228
.5784	$\bar{9}$,762228
.005784	$\bar{7}$,762228

In these five Examples, the Logarithm is the same, but the Index alters according to the Distance of the first significant Figure from Unity; as in the second Example, the Index of 5 is 2, but in the fourth Example, the Index of 5 is $\bar{9}$ with a Tittle, and of the last is $\bar{7}$, because the third from Unity is a Decimal.

§. 3. *To find the Number to a Logarithm.*

To find the Number to a Logarithm.

TO find the Number answering to a Logarithm given, omitting the Index, seek in the Table for the Logarithm equal or next less to the Logarithm given, the *Number* in the Column under N. with that on the top over the Logarithm, is the Number desired, which must be ordered according to the Index. Example. The Logarithm 3,544821; omitting the Index 3, I find 544821 to answer 3506, which the Index 3 shews to be all Integers; but if the Index had been 1, then the Number would have been 35.06, that is, 35 whole and .06 hundred Parts; and if $\bar{9}$, then .3506, all Decimals; if $\bar{8}$, then .03506, *&c.*

But if the Logarithm be not exactly to be found, and five Places be required, find the Number to four Places as before, noting the Common Difference under D, then take the Difference betwixt the Logarithm given, and

and the Logarithm found in the Table less than it; seek the Common Difference in the Table of Proportional Parts under D. and in that Line find out the Difference of the Logarithms, and at the top just above it you have the fifth Figure. Example of the Logarithm 2,543612, the Logarithm next less is 543571, answering to 3496; the Common Difference is 124, the Difference of the Logarithms is 41, which in the Table of Proportional Parts against 124 gives 3; so that the absolute Number is 34963, and because the Index is 2, the Number will be 349 whole and $\frac{63}{100}$ Parts, or 349.63

§. 4. *Addition of two or more Logarithms.*

Addition in Logarithms.

FIrst, If the Indices be both (or all) Integers or of whole Parts, add them as usually. But, Secondly, If the Indices be unlike, that is, some of Integers, some of Parts, and if the Sum of the Indices be 10, or above, cast away 10, the Remain is the Index of Integers; if under 10, Decimal Parts. Lastly, If the Indices be both of Decimal Parts, and when added be under 10, add 10 to them; if just 10, then Unity; if above 10, cast 10 away; the Index thus gotten is always Decimal Parts.

Examples.

2,057821	2,237242	$\bar{9}$,397941	$\bar{9}$,875061
$\bar{7}$,583210	$\bar{9}$,875062	$\bar{9}$,875062	$\bar{8}$,698972
	$\bar{8}$,698971		
$\bar{9}$,641031	0,811275	$\bar{9}$,273003	$\bar{8}$,574033

§. 5. *Subtraction in Logarithms.*

Subtraction in Logarithms.

IF the Indices be of Integers, then as usually. If the Indices be either or both of Decimals, observe whether the Index of the higher be a smaller Figure than the lower, if it be add 10 to it; and if the higher be of greater value than the lower, (that is, a bigger Index by Place) then the Remainder will be Integers; if not, Decimal Parts.

Examples.

2,033421	$\bar{9}$,875062	$\bar{9}$,875062	1,235781
$\bar{9}$,875062	2,033421	$\bar{8}$,574031	3,572141
2,158359	$\bar{7}$,841641	1,301031	$\bar{7}$,663640

The Logarithm of a Fraction is found, by subtracting the Logarithm of the Denominator from the Logarithm of the Numerator; as $\frac{3}{4}$; the Logarithm of 4 is 0,602060, out of the Logarithm of 3, 0,477121, leaves the Difference $\bar{9}$,875061, the Logarithm of .75 The

The most of the admirable Uses of the Logarithms are comprehended in the following Rules.

§. 6. *Multiplication by Logarithms.*

Multiplication by Logarithms.

TO multiply one Number by another, is nothing but to add their Logarithms, the Sum is the Logarithm of the Product.

Multiplicand	32	1,505150	5.12	0,709265
Multiplier	52	1,716003	1.55	0,190332
Product	1664	3,221153	7.936	0,899497

§. 7. *Division by Logarithms.*

Division by Logarithms.

TO divide one Number by another, is to subtract the Logarithm of the Divisor from the Logarithm of the Dividend.

Dividend	7286	3,862489	.4512	$\bar{9}$,654369
Divisor	32	1,505150	.0315	8,498311
Quotient	227.8	2,357359	14.32	1,156058

§. 8. *Extraction of the Square and Cube Roots.*

Extraction of the Square and Cube Roots.

TO square a Number is to multiply its Logarithm by 2, to cube it by 3, to square-square it by 4, &c. To Extract the Square Root is to halve the Logarithm, or divide it by 2. To Extract the Cube Root is to divide the Logarithm by 3, the Square-square by 4.

Examples.

Number	75832	*Logarithm*	4,879852
Square Root	275.37	2)	2,439926 *for the Square Root.*
Number	75832	*Logarithm*	4,879852
Cube Root	42.327	3)	1,626614 *for the Cube Root.*

Thus far all the several and Prime Parts of *Arithmetick* have been handled, hereafter the Comparative Part shall be shewed, which useth all the former Rules, and no other, and will by Practice easily be attained.

To end this Section, I shall insert the Characters of some Letters used by the *Romans*, and by People under their Subjection, and continued often in these days, and are these; I for 1, V for 5, X for 10, L for 50, C for 100, D for 500, and M for 1000; and sometimes thus Iɔ 500, cIɔ 1000; and note, that I before V or X, and X before L or C, takes away one or ten, as IX 9, IV 4, XL 40, XC 90, &c.

SECT.

SECTION VII.

Of the Comparative Part of Arithmetick.

§. 1. *The Golden Rule or Rule of Three.*

The Golden Rule or Rule of Three.

THe *Golden Rule*, *Rule of Three*, or of *Proportion*, is that by which most of the Questions of use in all manner of Traffick, or Business of this Life, are answered. I divide this Rule into four Parts: 1. *Direct*, 2. *Indirect* or *Backward*, 3. *Double Rule Direct*, 4. *Double Rule Indirect*.

The Single Rule of Three Direct.

Golden Rule Direct.

FIrst, The *Single Rule Direct* finds a fourth Number, in such Proportion to the third, as the second is to the first; or, As the first is to the second, so is the third to the fourth. Let the Terms stand thus;

1 . 2 :: 3 . 4

And note, That the first and third Terms, and the second and fourth, are of the same Denominations; as if the first be of Moneys, Weights, Measures, &c. so shall the third; and so as the second, the fourth.

This Rule requires (and is to be known thus) that if the second Term be greater or less than the first, the fourth Term shall be likewise greater or lesser than the third: Or in the Question, if more require more, or less less, then use this Rule Direct, and multiply the second and third Terms together, and divide the Product by the first Term, and it gives the fourth Term or Answer. Example. *If* 4 *Yards cost* 8 s. *what will* 8 *Yards cost?* Answer 16 *s.*

4 . 8 :: 8 . 16

This Rule bids you multiply 8 by 8, which makes 64, and divide by 4, and it gives 16 the Term required. Let that Term therefore of the three, which makes the Question, whether it be of Value or Price, be set in the third Place, and that which is of the like Name or Denomination set in the first Place, and the Number remaining set in the second, of which nature the Number sought must ever be. As for Example, if the Question be thus put, *What will* 9 *Yards cost, if* 2 *Yards be bought for* 5 s? Answer 22 *s.* 6 *d.*

2 . 5 :: 9 . 22½

Again, *If* 12 *Yards of Damask will line* 16 *Yards of Velvet, how much Damask will line* 24 *Yards of Velvet?* Answer 18. To be placed thus:

16 . 12 :: 24 . 18

The Rule requiring the multiplication of the second and third Terms, *viz.* 12 by 24 makes 288, which divided by 16, gives the Answer 18.

Therefore if an Unit or 1, as 1 Yard, 1 Pound, be in the first Term, then the Rule is wrought by Multiplication only. Example; *If* 1 *Yard cost* 16 *shillings, what will* 32 *Yards cost?* Answer (by multiplying 32 by 16) 512 shillings, or 25 *l.* 12 *s.* by dividing by 20.

Rules of Practice.

HEnce come those Rules called *Rules of Practice*, which shew the true Price or Value of any Parcel of Goods, sold by the Pound, Ell, Yard, Dozen, Gross, or any other Thing, whereof the first Term is one. *Rules of Practice.*

The first and plain ordinary way is by *Reduction*, or bringing the Price of the Pound, Yard, Ell, &c. into the lowest Denomination of usual Moneys, as hath been taught in *Reduction*. Example; *At* 1 s. 2 d. *the Pound, what comes* 152 *Pounds to?* Answer 8 *l.* 17 *s.* 4 *d.* That bring all into Pence, and say, *By Reduction.*

1 . 14 :: 152 . *q* *q signifies the fourth Term sought.*

152 by 14 gives 2128 Pence, which reduced by dividing by 12 gives 177 *s.* 4 *d.* that is 8 *l.* 17 *s.* 4 *d.* by halving of 17.

Example 2. *If* 1 *Pound cost* 3 s. 6 d. *what shall the great Hundred and* 5 *Pound cost?* First reduce the 3 *s.* 6 *d.* into Six-pences, that is 7 Six-pences, and because the great Hundred is 112 ℔. the Pounds will be 117. Then the Question will stand thus:

1 . 7 :: 117 . Answer 819

117 by 7 is 819 Six-pences, which is 409 *s.* 6 *d.*, that is 20 *l.* 9 *s.* 6 *d.*

But if the Price fall out to be the *Aliquot* or Even Parts of a Pound, or of a Shilling, then the Work may be short'ned much; as for Example: The Even Parts of a Shilling are these, 6 *d.* the half, 4 *d.* the third part, 3 *d.* the fourth part, 2 *d.* the sixth part, 1 *d. ob.* the eighth part, and 1 *d.* the twelfth part: Therefore if any Question, wherein 1 is in the first place, be proposed, and if any of these Parts be in the second, you may find the fourth Term by taking the Part of the third, as is here required. *By Aliquot Parts.*

At 6 d. *the Yard, what comes* 352 *Yards to?* Answer 176 *s.* by taking the half of 352, which is 176 *s.* or 8 *l.* 16 *s.*

At 3 d. *the Yard, or Pound, or Ounce, what comes* 74 *to?* Answer 18 *s.* 6 *d.* by dividing 74 by 4, as before, which is 18 *s.* 6 *d.*

But if the Question fall not right upon any of these Aliquot Parts, then

you must work oftner, as, *At* 10 d. *the Pound, what will* 133 *Pound give?* Answer 5 *l.* 10 *s.* 10 *d.* by dividing 133 by 2 for 6 *d.* which will be 66 *s.* 6 *d.* and then by 3 for 4 *d.* which makes 44 *s.* 4 *d.* in all 110 *s.* 10 *d.* or 5 *l.* 10 *s.* 10 *d.* So for 8 *d.* take 4 *d.* twice; for 9 *d.* take 3 *d.* thrice; for 11 *d.* take 6 *d.* 3 *d.* and 2 *d.*

The Aliquot Parts of a Pound are, 10 *s.* the half, 5 *s.* the fourth part, 4 *s.* the fifth part, 2 *s.* the tenth part, and 1 *s.* the twentieth part: So 6 *s.* 8 *d.* is the third part, and 3 *s.* 4 *d.* the sixth part. Then to answer such Questions as fall upon these Even Parts, divide by these Even Parts, the Answer is Pounds, and the Remain shall be so many of those Parts as that part requires. Examples.

If 1 *Pound cost* 10 s. *what will* 135 *l. cost?* Answer 67 *l.* 10 *s.* Take the half of 135, which is 67 *l.* and 1 remains, which is 10 *s.*

At 4 s. *the Yard, what comes* 89 *Yards to?* Answer 17 *l.* 16 *s.* I divide 89 by 5 *s.* which gives 17 *l.* and 4 remains, which is 16 *s.*

But if it chance that the Question fall not upon those Parts, but upon others, as 8 *s.* take 4 *s.* twice, if upon 14 *s.* take 10 *s.* and 4 *s.* Example. *At* 9 s. *the Gross, what comes* 36 *Gross to?* I take 5 *s.* and 4 *s.* which is the fourth and fifth parts, and take those parts of 36, *viz.* the fourth part is 9 *l.* and the fifth part is 7 *l.* 4 *s.* in all 16 *l.* 4 *s.*

Even Parts of a Pound.		*Parts.*	*Uneven of a* l.	*Divided into even Parts.*	*Parts.*	*Even Parts of an Hundred-weight.*	
s.	*d.*		*s.*	*s.*			
10	00	½	19	10 5 4	2 4 5	56	½
6	08	3	18	10 4 4	2 5 5	28	4
5	00	4	17	10 5 2	2 4 10	16	7
4	00	5	16	10 4 2	2 5 10	14	8
3	04	6	15	10 5	2 4	8	14
2	06	8	14	10 4	2 5	7	16
2	00	10	13	4 4 5	5 5 4	4	28
1	08	12	12	10 2	2 10	2	56
1	03	16	11	5 4 2	4 5 10	1	112
1	00	20	9	5 4	4 5		
0	10	24	8	4 4	5 5	*Fractions of an Hundred-weight.*	
0	08	30	7	5 2	4 10		
0	06	40	6	4 2	5 10		
Even Parts of a Shilling.			3	2 1	10 20	98	7.8
			Of a s.	*d.*		96	6.7
6 *d.*		½	11 *d.*	6 3 2	2 4 6	84	3.4
4		3	10	6 4	2 3	80	5.7
3		4	9	3 3 3	4 4 4	70	5.8
2		6	8	4 4	3 3	64	4.7
1		12	7	4 3	3 4	48	3.2
1 *ob.*		8	5	3 2	4 6	32	2.7

But

But because all this may the better be made plain and easie, I have added yet a more compleat Division of the Even Parts of a Pound, and the Uneven; the like of Pence, and the Even Parts of an Hundred Weight, and the Fractions of it. The Even Parts of Pounds and Shillings were before declared, the Uneven Parts are thus explained; as, for 11 *s.* the Table bids take 5 *s.* 4 *s.* 2 *s.* which are the fourth, fifth, and tenth parts; for 11 *d.* take 6 *d.* 3 *d.* and 2 *d.* which are the half, fourth, and sixth part.

The Uses are gathered easily from what hath been before taught; so that if this Question was proposed, *What comes* 3 *Peeces of Broad Cloth to, at* 1 l. 12 s. 8 d. *the Yard, every Peece being* 27 *Yards long?* First find the Yards, that is 3 times 27, which is 81, then multiply 81 by the Pounds, which here being but 1 makes 81; then for 12 *s.* take the tenth part and half of 81, which is 48 *l.* 12 *s.*; then for 8 *d.* take the third part twice, which is 54 *s.* in all 132 *l.* 6 *s.*

Examples in Practice for Navigation.

1. About the Building of a Vessel, *At* 11 l. 15 s. *the Tun, what will a Ship of* 342 *Tun cost?* First multiply 342 by 11, and it makes 3762 *l.* then for 15 *s.* take the fourth part three times, which comes to 256 *l.* 10 *s.* in all 4018 *l.* 10 *s.*

2. About the Parts, *What will the Sixteenth Part of a Ship that cost* 2432 l. 8 s. *come to?* Turn the Pounds into Shillings, which are 68648 *s.*, which divided by 16 gives 4290 ½ *s.* that is 214 *l.* 10 *s.* 6 *d.*

3. About the Freight, *What comes* 342 *Tun to, at* 3 l. 10 s. *the Tun?* Multiply 342 by 3, and it gives 1026 *l.* take half of 342 for 10 *s.* and it gives 171 *l.* in all 1197 *l.*

4. About Wages, *At* 23 s. 4 d. per *Month for a Seaman, what is due after* 2 *Years and* 3 *Months?* The Months are 27; therefore the whole Pounds are 27, and for the 3 *s.* 4 *d.* the sixth part of 27, which is 4 *l.* 10 *s.* in all 31 *l.* 10 *s.*

5. For Averidge, or Loss by inevitable Accident, *The Loss comes to* 943 l. *the Value of the Goods aboard the Ship is* 18000 l. *what shall that Person pay that had Goods aboard worth* 3246 l?

18000 . 943 :: 3246 . Answer 170 *l.* 1 *s.* 1 *d.*

By multiplying the second and third, and dividing the Product by 18000, you have 170,0544, which by the Decimal Table comes to 170 *l.* 1 *s.* 1 *d.*

I will give one Question more in the *Rule Direct*, and work it at large four several ways, *viz.* 1. By the ordinary way of *Reduction*: 2. By *Fractions*: 3. By *Decimal Arithmetick*: And 4. By *Logarithms*. Which being rightly known, I will not further work any Question at large, because I desire to be short. Let this Question therefore be understood.

What

What shall $\frac{3}{4}$ *of a Yard of Velvet cost, when the Peece of* 21 $\frac{1}{2}$ *Yards cost* 24 l. 6 s. 8 d?

By Reduction. First, By *Reduction*. The Rule stands thus:

21 $\frac{1}{2}$. 24 *l.* 06 *s.* 08 *d.* :: $\frac{3}{4}$. *q*

Because the first and third Terms must be of one Name, I bring 21 $\frac{1}{2}$ Yards into Quarters, and they will be 86 Quarters; then I bring 24 *l.* 6 *s.* 8 *d.* into Pence, by multiplying by 20 and 12, as was taught before, which makes 5840 Pence; and the Rule stands thus:

86 . 5840 :: 3 . Answer 203 *d.* 3 *f.*

```
           3
86 ) 17520 ( 203 62/86
     172
     ---
       320
       258
       ---
        62
```

For to find the Farthings, I multiply 62 by 4, and it makes 248, which divided by 86 gives 3. Now 203 *d.* being divided by 12 gives 16 *s.* 11 *d.* So the Answer is 16 *s.* 11 *d.* and $\frac{3}{4}$ or 3 *f.*

By Fractions. Secondly, By *Fractions*. The Rule will stand thus:

21 $\frac{1}{2}$. 24 $\frac{1}{3}$ :: $\frac{3}{4}$. *q*

I multiply 24 $\frac{1}{3}$, or $\frac{73}{3}$, by $\frac{3}{4}$, and it will give $\frac{73}{4}$, because the Byas 3 may be put out of them both. Then $\frac{43}{2}$) $\frac{73}{4}$ (or $\frac{43}{1}$) $\frac{73}{2}$ ($\frac{73}{86}$. Now I seek how many Shillings, Pence, and Farthings, are in $\frac{73}{86}$, that is, I multiply 73 by 20, and it makes 1460, which divided by 86 gives 16 *s.* and there remains $\frac{84}{86}$. I multiply 84 by 12, and it gives 1008, which divided by 86 gives 11 *d.* and there rests $\frac{62}{86}$; which multiplied by 4, and divided by 86, gives 3 *f.* in all 16 *s.* 11 $\frac{3}{4}$ *d.* for three Quarters of Velvet.

By Decimals. Thirdly, By *Decimals*. By the Table I put the Question into Decimal Fractions, and the Rule will stand thus:

21.5 . 24.3333 :: .75 . *q*

I multiply the two middle Terms together, which gives 18.249999, this I divide by the first Term 21.5, and it gives in the Quotient .8488, which in the Decimal Table gives 16 *s.* 11 $\frac{3}{4}$ *d.*

Fourthly,

Fourthly, By *Logarithms*. Set the first, second, and third Terms, in Decimals, as in the following Example, and find their respective Logarithms. *By Logarithms.*

21.5	1,332438
24.3333	1,386195
.75	$\bar{9}$,875061
	1,261256
.8488	$\bar{9}$,928818

I add the Logarithms of the second and third together, which makes the Logarithm 1,261256, from which I take the first Logarithm 1,332438, and there rests the Logarithm $\bar{9}$,928818, which being sought in the Canon gives the Number 8488, and because of the Index $\bar{9}$ they are all Decimals, and being sought for in the Table, as before, gives 16 *s.* 11 $\frac{3}{4}$ *d.*

Note, That in this Rule, if you multiply the second and third Terms together, the Product shall be equal to the Product of the first Term multiplied by the fourth, which may very well prove it, if required.

The Backward or Indirect Rule of Three.

SEcondly, The *Backward* or *Indirect Rule of Three*, which is known by being contrary to the *Direct*; for whereas the former required, that more shall have more, and less, less; as, if 4 Yards cost 2 *s.* 8 Yards will cost more than 2 *s.* because it is double to 4 Yards, and so must the Answer be double to 2 *s. viz.* 4 *s.* But in this Rule more will require less, and less more; as, if 4 Horses in 6 Days eat 10 Bushels of Oats, 8 Horses will eat 10 Bushels in a fewer quantity of Days, *viz.* in 3. Here 10 Bushels being common is omitted, and the Question will stand thus: *Backward or Indirect Rule.*

4 . 6 :: 8 . 3

And the Rule bids you multiply the first and second Terms for a Dividend, which divide by the third, and the Quotient gives the Answer or fourth Term; as in the last Question, multiply 4 by 6, and it gives 24, which divided by 8 gives 3.

Example 1. *If 20 Pioneers can finish a Work in 2 Months and 10 Days, how many Pioneers will finish that Work in 20 Days?* Answer 66 Days.

Example 2. *If for the Matting of a Room there needs 100 Yards of a Yard broad, how many Yards will be needful of* $\frac{3}{4}$ *broad?* In Decimals thus:

1 . 100 :: .75 . 133.33

Having put $\frac{3}{4}$ into .75 divide 100 by it, and the Quotient will be the Answer, *viz.* 133.33 or 133 $\frac{1}{3}$.

Example

Example 3. *If a* 2 d. *Loaf of Bread weighed* 6 lb. 3 ℥. *when a Bowl of Rye cost* 6 s. 6 d. *what is a Bowl of Rye worth when a* 2 d. *Loaf of Bread weighs* 2 lb. 4 ℥? Answer 17*s.* $10\frac{1}{2}$ *d.*

The Double Rule of Three.

Double Golden Rule.

THirdly and Lastly, The *Double Rule*, both *Direct* and *Indirect*, or Forward and Backward, I comprise into one Rule, with two Operations only, which is usually wrought by two Positions of the *Golden Rule*.

Observe, That the given Terms are always five, whereof three are conditional and antecedent, or suppositious, the other two demand the Question, and are Consequents, matching or answering some of the former Antecedents; in so much, that with the Answer there will be as many Consequents as Antecedents, which must match one another in the same Denomination exactly.

Now for the right placing of the Question and Terms, first, the three Terms of the conditional Part are duely to be regarded: Let that which is the Principal Cause of Loss or Gain, Increase or Decrease, Action or Passion, be put in the first Place; that which betokeneth the Space of Time, Distance of Place, *&c.* be put in the second Place; and the remaining part in the third. The conditional Part thus stated, the other two Terms wherein the Demand lyes, must be placed so under the former Terms, that they may correspond one with another.

Rule I. Then, *If the Blank, or Place sought, fall under the third Term, multiply the three last Terms for a Dividend, and the two first for a Divisor, and the Quotient gives the sixth Term desired.*

Rule II. But, *If the Blank fall under the first or second Terms, multiply the first, second, and fifth Terms for a Dividend, and the third and fourth for a Divisor; the Quotient gives the Answer.* Examples will make all plain.

Example 1. *If* 12 *Rods of Ditching be done by* 2 *Men in* 6 *Days, how many Rods shall be wrought by* 8 *Men in* 24 *Days?* Answer 194.

Men.	*Days.*	*Rods.*
2	6	12
8	24	

Here Men, the Cause, is in the first Place, Days in the second, Rods in the third; the Match-Terms, 8 and 24, being placed as in the Example; the Blank is under third; wherefore 12 in 8 in 24 makes 2304 for the Dividend, and 2 in 6 makes 12 for the Divisor; the Quotient gives 192 Rods of Ditching to be done by 8 Men.

12) 2304 (192

Example 2. *If* 2 *Men work* 12 *Rod in* 6 *Days, how many Men will work* 192 *Rods in* 24 *Days?*

Set the Rule as before is taught, and the Blank will fall under the first Term, which by the second way will give 8 Men.

Men.	*Days.*	*Rods.*
2	6	12
	24	192

Here I multiply the first, second, and last for the Dividend, *viz.* 2 in 6 in 192 makes 2304, and the third and fourth for the Divisor, *viz.* 12 in 24 makes 288.

288) 2304 (8

Simple Interest.

Questions of Simple Interest belong to this Rule, of which take this Example: *If* 100 l. *in* 12 *Months give* 6 l. *what shall* 40 l. *in* 6 *Months give?* *Simple Interest.*

l.	*Months.*	*l.*
100	12	6
40	6	

6 in 40 in 6 is 1440 for the Dividend, and 100 in 12 is 1200 for the Divisor.

1200) 1440 (1.2, that is, 1 *l.* 4 *s.*

If there be the same Supposition, and it be required to know the Principal that yielded 1 *l.* 4 *s.* in 6 Months, the Answer will be 40 *l.* by the second way.

100	12	6
	6	1 *l.* 4 *s.*

These Rules will work best by Decimals, where the Year is the Integer, Months and Days are Decimals.

§. 2. *Fellowship or Partnership.*

THe Rule of *Fellowship* or *Partnership* is of very great use to Ballance Accompts, and for Accompts amongst Merchants and Owners of Ships; for when any number of Persons put together a general Stock, so that it be required to give to every one his proportional Share of the Loss or Gain, the *Golden Rule* several ways repeated will fully answer such Questions. For, *As the whole Stock,* (or general Antecedent) *is to the Total thereby gain'd or lost*; (which is the general Consequent:) *So each Man's particular Share, is to his proper Share of Loss or Gain.* Wherefore, let the several Moneys of every Partner be gathered into one Sum, which make the first Term, the common Gain or Loss the second, every Man's par- *Fellowship or Partnership.*

ticular

ticular Share the third, working the *Golden Rule* so many several times as there are Partners.

There be two Parts of this Rule, *without Time*, and *with Time*.

Fellowship without Time.

Fellowship without Time.

A, B, *and* C *fraight a Ship with Wine*, viz. A *lays out* 1342 l. B 1178 l. C 630 l. *the whole* 212 *Tun of Wine is sold at* 32 l. *a Tun; what shall each Man receive?* First, I find out the Price received, by multiplying 212 by 32, which makes 6784; then I add up the several Stocks, 1342 *l.* 1178 *l.* and 630, which make 3150 *l.* and the work will stand thus:

$$3150 \cdot 6784 :: \left\{\begin{array}{l} 1342 \;.\; \text{Answer } 2890.199- \\ 1178 \;.\; \text{Answer } 2537.001+ \\ \underline{\;630} \;.\; \text{Answer } \underline{1356.800} \end{array}\right.$$

$$\textit{Proof}\quad 3150 \qquad\qquad 6784$$

If one dye indebted to eight several Persons, *viz.* to A 100 *l.* to B 86 *l.* to C 75 *l.* to D 60 *l.* to E 54 *l.* to F 32 *l.* to G 24 *l.* to H 15 *l.* and all his Goods will but amount to 150 *l.* the Creditors dividing according to Proportion, their Shares will be in Decimals, A 33.5323, B 28.9238, C 25.2242, D 20.1802, E 18.1514, F 10.7623, G 8.0517, and H 5.4448; all which make up 150 *l.* their whole Debt being 446 *l.* which is the Proof of this Rule.

A *hath Half a Ship*, B *a Quarter*, C *One Sixteenth*, *and* D *Three Sixteenths*, *the Master of the Ship brings an Account*, *and clears* 120 l. *how much must each Person have?* Accompt the Ship 16, and the Gain 120 *l.*

$$16 \cdot 120 :: \left\{\begin{array}{l} 8 \;.\; \text{Answer } 60 \\ 4 \;.\; \text{Answer } 30 \\ 1 \;.\; \text{Answer } 7.5 \\ 3 \;.\; \text{Answer } \underline{22.5} \\ \qquad\qquad\quad 120 \end{array}\right.$$

Fellowship with Time.

Fellowship with Time.

A Ships Company, viz. *Officers*, *Midship-Men*, *and Sailors take a Prize of* 300 l. *which is to be divided amongst them*, *according to their Pay and the Time they have been on Board; the Officers and Midship-Men* 5 *Months*, *and the Sailors* 3 *Months; the Officers one with another* 40 s. per *Month*, *the Midship-Men* 30 s. per *Month*, *and the Sailors* 22 s. per *Month; there were* 6 *Officers*, 12 *Midship-Men*, *and* 84 *Sailors: What must each Party have of the Prize?* For a general Stock I begin first with the Officers, which are 6, and that multiplied by the Rate of 40 *s.* gives 240, which multiplied by the 5 Months makes 1200 *s.* After the same fashion I find the Midship-Men's Stock 1800 *s.* and

and the Sailors 5544 *s.* All added together make 8544 *s.* for the whole Stock, and the Work will stand thus:

$$8544 \cdot 300 :: \left\{\begin{array}{l} 1200 \;.\; \text{Answer } 42.1232 \\ 1800 \;.\; \text{Answer } 63.2029 \\ 5544 \;.\; \text{Answer } 194.6629 \end{array}\right\} \overset{l.}{299.999} = \overset{l.}{300}$$

And turning the Decimals into Money by the Table, it will give for

	l.	s.	d.
Officers	42	02	06
Midship-Men	63	04	00¾
Sailors	194	13	05

A, B, *and* C, *enter into Partnership the first of* January *for a whole Year*, A *the same Day disburs'd* 100 l. *whereof he received back again upon the first of* April 20 l. B *payeth in the first of March* 60 l. *and more the first of* August 100 l. C *payeth in the first of* July 140 l. *but the first of* October *withdraweth* 40 l. *at the Years end their clear Gain is* 142 l. *How much thereof ought every particular Person to have?* Answer, A 51 *l.* B 55 *l.* C 36 *l.* which makes the whole Gain 142 *l.* without consideration of Interest. For A, 100 into 3 is 300 *l.* and 80 in 9 is 720, in all 1020 *l.* for A. For B, 60 in 10 makes 600, more 100 in 5 is 500, in all 1100 for B. For C, 140 in 3 is 420, and 100 in 3 is 300, in all 720 for C. Now 1020, more 1100, more 720, makes in all 2840 for the general Antecedent, and the Gain 142 for the general Consequent; then the Rule will stand thus:

$$2840 \cdot 142 :: \left\{\begin{array}{l} 1020 \;.\; \text{Answer } 51 \\ 1100 \;.\; \text{Answer } 55 \\ \;\;720 \;.\; \text{Answer } 36 \end{array}\right\} \text{which in all is } 142\,l.$$

SECTION VIII.

Of Simple and Compound Interest.

§. *Simple Interest.*

SIMPLE INTEREST is of Use amongst Merchants, and to find the Resolution of such Questions, as are commonly proposed of this kind, which are the Forbearance of Money, or Rebate, which is the present Worth of Money due hereafter, the Time is accompted by Days, which by the following Table is easily found. *Simple Interest.*

334	*January*	0
306	*February*	31
275	*March*	59
245	*April*	90
214	*May*	120
184	*June*	151
153	*July*	181
122	*August*	212
92	*September*	243
61	*October*	273
31	*November*	304
0	*December*	334

This Table contains three Columns, the laſt ſhews the Days from the firſt of *January*, or the beginning of the Year, to the beginning of each Month through the whole Year; the middle Column contains the Names of the Months; and the firſt ſhews the Days from the laſt of *December* to the ending of each Month. Now there being in one Year 365 ¼ Days, in two Years 730 ½, in three Years 1095 ¾, and in four Years 1461 Days, if the Queſtion be of intermediate Times, it will be from the Beginning of a Year, or in the Middle, or Part of two Years.

Example 1. From the Beginning of the Year to the Eleventh of *October* will be found 284 Days; for by the third Column in the Table from the Beginning of the Year unto *October* is 273 Days, which added to the 11 Days in *October* makes 284.

Example 2. From the Twelfth of *March* to the Sixteenth of *December* will be found 279 Days; for from the Beginning of the Year to the Twelfth of *March* is 71, found as before, and ſo to the Sixteenth of *December* 350 Days, now take 71 from 350, and there remains 279.

Example 3. From the Tenth of *June*, 1677, to the Fifth of *February* following, will be found 240 Days; for by the firſt Column to the laſt of *June* is 184, which added to 20 Days in *June* makes 204, to which adding the 31 Days in *January*, and the 5 in *February*, it makes in all 240.

Having found the Days as before, the next Table will ſhew the Simple Intereſt of One Pound for any Number of Days, under 10000, at 6 *per Centum*.

The firſt Column of which Table ſhews the Days, and may be Thouſands, Hundreds, Tens, or ſingle Days, and the other Columns ſhew the Intereſt of 1 *l.* according to the Number of Days in the firſt Column.

Days.

	Thouſands.			*Hundreds.*		*Tens.*	*Units.*
	l.	*s.*	*d.*	*s.*	*d.*	*d.*	*Parts.*
1	00	03	03.452	00	03.945	00.394	.039
2	00	06	06.904	00	07.890	00.789	.079
3	00	09	10.356	00	11.835	01.183	.118
4	00	13	01.804	01	03.780	01.578	.157
5	00	16	05.260	01	07.726	01.972	.197
6	00	19	08.712	01	11.671	02.367	.236
7	01	03	00.164	02	03.616	02.761	.276
8	01	06	03.616	02	07.561	03.156	.316
9	01	09	07.068	02	11.506	03.550	.355

Example.

What is the Uſe of 1 l. *for* 1732 *Days?* Anſwer 5 *s.* 8 ¼ *d.*

Days.		*s.*		*d.*
1000	=	03	:	03.452
700	=	02	:	03.616
30	=	00	:	01.183
2	=	00	:	00.079
1732	=	05	:	08.330

And if you turn the Intereſt of 1 *l.* found as before, into Decimals, and multiply it by any Sum propounded, it gives the Intereſt of that Sum for the Days propounded, at 6 *per Cent.* Simple Intereſt.

But if you would work the ſaid Queſtions by Numbers without the Table, you muſt know that the Intereſt of 1 *l.* for one day at 6 *per Cent. per Ann.* is .000164384, at 5 *per Cent.* .0001369836, both of them found by dividing 6 or 5 by 365, and if it be required to give the Simple Intereſt of any Sum for a certain Number of Days at 6 *per Cent.* find the Intereſt of 1 *l.* for that time, by multiplying .000164384 by the Days, and multiply the Intereſt found by the Sum propoſed, and it gives the Anſwer. Or eaſily by the Logarithms, thus: Add the Logarithm $\bar{6}$,215862 for 6 *per Cent.* or $\bar{6}$,136665 for 5 *per Cent.* to the Logarithm of the Days, and to the Logarithm of the Sum propoſed, the Sum of theſe three Logarithms is the Logarithm of the Intereſt. And for the Rule for Rebate, or the Preſent Worth of a Sum of Money due ſome Days after, find the Intereſt of 1 *l.* for that time, and add an Unit to it, by which divide the Sum propounded, and the Quotient gives the Preſent Worth. Thus much of *Simple Intereſt.*

§. 2. *Of*

§. 2. *Of Compound Interest.*

Compound Interest.

QUestions of *Compound Interest*, or *Interest upon Interest*, are most easily answered by Logarithms, and being prepared with Logarithms, if the Interest be at 6 *per Cent.* find the Logarithm of 1.06, and divide it by 2 for Half-Years, by 4 for Quarters, by 12 for Months, by 52 for Weeks, and by 365 for Days, as in the Table annexed, which will be of special use to answer Questions of this nature.

Logarithm of 1.06	0,025306
Half-Year	0,012653
Quarter	0,006326
A Month	0,002109
A Week	0,000527
A Day	0,000075

The Six Propositions, for resolving Questions of *Compound Interest* and *Annuities*, at 6 *per Cent.* proposed by Mr. *Oughtred*, , and performed in as many Resolutions following, noted with these six Letters, *A*, *B*, *C*, *D*, *E*, *F*, are:

Prop. I. P *lends to* R 1 l. *for 3 Years, what must* P *receive at the End of the Term?* Answer *A* 1 *l.* 3 *s.* 10 *d.*

Prop. II. R *oweth unto* P 1 l. *to be paid at the End of 3 Years,* P *desires his Money presently, what is it worth in ready Money?* Answer *B* 16 *s.* 9 ½ *d.*

	1.06	0,025306	
		3	
A	1.1910	0,075918	
B	.8396	$\overline{9}$,924081	Arithm. Compl.

By multiplying the Logarithm of 1.06 by 3 gives 0,075918, the Logarithm of *A*, which is 1 *l.* 3 *s.* 10 *d.* And taking the Arithmetical Complement of that Logarithm, by subtracting it from 10, it gives the Logarithm $\overline{9}$,924081 for B, .8396, or 16 *s.* 9 ½ *d.*

Prop. III. P *hath an Annuity of* 1 l. per Annum *to be paid by* R, *who forbears Payment for 3 Years, what will it then amount unto?* Answer *C* 3 *l.* 3 *s.* 8 *d.*

Prop. IV. R *is to pay unto* P 1 l. *at the End of 3 Years, but desires to pay an Annuity or Yearly Rent, what must* R *pay every Year for these 3 Years?* Answer *D* 6 *s.* 3 ½ *d.*

A less

A less 1 is .191	Logarithm	$\overline{9}$,281033
1.06 less 1 is .06		$\overline{8}$,778151
C 3.1833	Difference	0,502882
D 0.3141	Arithm. Compl.	$\overline{9}$,497117

A by the first Proposition was 1.191, which must be made less by 1, and it leaves .191, and 1.06 less by 1 is .06. The Difference of their Logarithms is 0,502882, the Number answering is *C* 3 *l.* 3 *s.* 8 *d.* which resolves the Third Proposition; and the Arithmetical Complement of the last Logarithm is $\overline{9}$,497117, the Number is 6 *s.* 3 ½ *d.* which gives *D* the Answer of the Fourth Proposition.

Prop. V. P *has an Annuity of* 1 l. per Annum, *for 3 Years, what is the Present Worth in ready Money?* Answer *E* 2 *l.* 13 *s.* 5 ½ *d.*

Prop. VI. P *has* 1 l. *to bestow upon an Annuity for 3 Years, what will it purchase Yearly?* Answer *F* 7 *s.* 6 *d.*

C 3.1833	Logarithm	0,502882
A 1.191	Logarithm	0,075918
E 2.6728	Difference	0,426964
F .3741	Ar. Compl.	$\overline{9}$,573036

Subtract the Logarithm of *A* 1.191 from the Logarithm of *C* 3.1833, it leaves the Logarithm of *E*, whose Number is 2.6728, and answers the Fifth Proposition; and the Arithmetical Complement is the Logarithm of *F*, whose Number is .3741, and answers the Sixth Proposition.

Thus for 1 *l.* the Answers are fitted to all the Six Propositions, and the like Work must be made, if the Payments were half-yearly, quarterly, *&c.* taking the Logarithm answering in the little Table before expressed, and after the Answer is found for 1 *l.* by adding its Logarithm to the Logarithm of any other Sum, it gives the Answer accordingly. Example, if 352 *l.* 10 *s.* were due three Years hence, and it is desired to know the Present Worth, after the Rate of 6 *per Cent.* I add the Logarithm of 352.5, which is 2,547159, to the Logarithm of *B* $\overline{9}$,924081, found by the Second Proposition, and the Sum is 2,471240, the Logarithm of 295.97, or 295 *l.* 19 *s.* 6 *d.*

CHAP.

CHAP. II.

Of Practical GEOMETRY.

Practical Geometry.

I Now come to show you the Second *Step*, whereby you may ascend to the admirable Knowledge of the *Mathematicks*; for *Arithmetick* and *Geometry* are the *Foundations* of what we are about; and though I now defer the Teaching you the *Theory*, which you will have in the Last Part, yet the *Practice* you are now beginning, and I am ready to deliver you, will settle you to the Use of the Compasses, and make you ready to measure whatsoever is Quantity, whether it be Distance on the Sea or Land, Heights of Hills, Mountains, Towers, Depths, Superficies, and Bodies; besides the Roundness of the Earth, and the Height or Distance of the Heavenly Bodies. I have not gone the ordinary way, I hope a better, more intelligible, and fitter for Use. I first begin some *Definitions*, mixing *Propositions* along, as the nature of them require, and according to my Ability to make all easie, and so to be retained in the Memory.

SECTION I.

Of several Definitions and Problems for Measures.

Definitions and Problems for Measures. *Fig.* 1, 2, 3.

THere are but Three *Dimensions*, *viz.* a *Line*, which is only Length; a *Superficies*, which is Length and Breadth; and a *Solid*, which is Length, Breadth, and Thickness; expressed by the first, second, and third Figures in the first Plate.

Prop. I. *Of a Line.*

Line. *Fig.* 4.

A Straight Line, as *a b*, is drawn upon Paper commonly with a Ruler *b c*, and by turning the Ruler end for end, as *c* where *b* was, you may try whether it draws a straight Line or not, for if it trace by a Point the same Line again, the Ruler is straight.

To

To draw a straight Line upon the Ground which is level, as between *a* and *b*, set up some Pickets, as *c* and *d*, which shall cover the Mark *b* standing at *a*, and by them (or as many as need be) with a Line, Chord, or Chain, you may mark out the Line *a b* on the Ground. *Fig.* 5

Long Measures.

But before I proceed any further, I must make known to you the ordinary Measures of our own Country, and repeat again part of the Table of *Long Measures*, before laid down in the *Arithmetick*, *Cap.* 1. *Sect.* 2. § 1. *viz.* a *Palm* is 3 Inches, a *Foot* is 12 Inches, a *Yard* is 3 Feet or 36 Inches, a *Pace* is 5 Feet or 60 Inches, a *Pole* is 5 Yards and an half, a *Furlong* is 40 Pole, and a *Mile* is 8 Furlongs; the Gage for all these is the *Yard Standard* at *Guild-Hall*. But divers Countries have their divers Measures, as you will find by the Table in the Third Part, called *Foreign Weights and Measures compared with the English*, to which I refer you. Note likewise, that three Miles *English* or *French* are called a *League*.

Plain Scale.

Thus, whatever Line you measure upon the Ground or otherwise, whether by Inch, Foot, Yard, Pole, or Mile, you may make a Scale, by which the same may be represented and laid down in a straight Line, upon Paper or what else you think fit, (which Scales are called *Plane Scales*) after this manner: First, that all Plane Scales may be known, an Inch is commonly taken for the Common Measure to know them by, as in the seventh Figure, where the Scale *a b* is divided into 6 Inches, and the first Inch *b c* is divided into 10 Parts, which being made the Scale for your Measure, every Part is the Tenth of an Inch; in the next Scale every Part is the Twelfth, in the next the Twentieth, and the next the Thirtieth; all which the Boys must be made to understand. *Fig.* 7.

Diagonal or Decimal Scale. *Fig.* 8.

But because these Scales only express the Tenths of Parts, there is another Scale yet more exact of ordinary use, called a *Diagonal* or *Decimal Scale*, as in the eighth Figure you may see; the Exactness ariseth from the Breadth, as in this Scale one Tenth of an Inch is actually divided into Ten Parts by the Diagonal, as in the Uses of this Scale shall hereafter be shewed you.

Prop. II. *Of a Circle.*

THe whole Business of Dimension depending upon measuring of Lines and Angles, which last relate to a Circle, I have thought good to treat of a Circle in the second Place.

Circle. *Circumference.* *Radius.* *Diameter.* *Fig.* 9.

A *Circle* is described ordinarily with a Pair of Compasses, one End remaining fixt, the other moving about makes that Line which is called the *Circumference* or *Arch*, the Point fixt is called the *Center*, and the Distance from that Center to the Circumference (which remains always the same whilst you describe it) is called the *Radius* or *Semidiameter*, the Line that passeth from one part of the Circumference by the Center to the other is called the *Diameter*, equal to two *Radius's*; as in the ninth Figure, *c* is the Center, *a e b d* is the Circumference, *c a*, *c b*, *c e*, and *c d* are all Semidiameters or *Radii*, and *e d* or *a b* are Diameters.

All

Degrees. All Circles whether greater or lesser are divided commonly into 360 Parts, called *Degrees*, that Number allowing many Aliquot or Even Parts, as the Half is 180, the Third Part 120, the Fourth 90, the Fifth 72, the Sixth 60, the Eighth 45, the Ninth 40, the Tenth 36, the Twelfth 30, the Fifteenth 24, and the Eighteenth Part is 20.

Division of a Circle. The Compasses at the same opening will go exactly 6 times about, or will describe each time 60 Parts or Degrees; therefore to divide any Circle into 360 Parts, set off 60 Degrees 6 times, as in *f g a h i b*, divide each 60 into Halves, which is 30, and each 30 into 3 Parts, which will be 10 Degrees, each 10 Degrees into Halves for 5 Degrees, and each of those into 5 Parts by 4 Points into Degrees; as you see in the Figure. *Fig. 9.*

Every Degree (if the Circle be so large) may be divided into 60 Parts called *Minutes*, and every Minute into 60 Parts called *Seconds*, and so into *Thirds*, *Fourths*, &c. so that all Circles, whether as great as the Heavens, or as little as a Penny, are always accounted to contain 360 Degrees, as you see in the little Circle *m n o p*. So that if you make two or three Circles greater than one another, and divide them as I have taught into 360 Degrees each, (which I advise you to do) they will be of good use. *Fig. 9.*

Quadrant. The *Quarter* of the Circle, or 90 Degrees, is called a *Quadrant*, there being 4 such in every Circle, *viz.* *b c e*, *e c a*, *a c d*, and *d c b*, which will be sufficient for the whole, if divided into 90 Parts.

Semicircle. Two Quadrants, or that Part which is divided by a Diameter is called a *Semicircle*, which contains 180 Degrees, as in the same Figure, *a c b c* is a Semicircle.

Prop. III. *Of a Plain Right Lined Angle.*

Angle. THis is made by the Concourse of two straight Lines not lying direct, and is of three sorts, *viz.* a *Right* Angle, an *Acute* Angle, or an *Obtuse* Angle, all which are measured by a Circle, or Part of a Circle, for every one of these Angles contains so many Degrees, Minutes, &c. of a Circle, as are comprised or intercepted betwixt the two Sides of that Angle, (produced if need be) neither doth the Length of those two Sides, or a bigger or lesser Circle, alter the same at all. As in the Tenth Figure, if upon the Point *c* in the Line *g a* you move another Line, suppose *c b*, and beginning at *a* move it towards *d*, 'till it makes an Acute Angle, and contains less Degrees than 90, as the Angle *b c a* is 30 Degrees, but when it comes to *d*, it is then 90 Degrees, and is called a *Rectangle*, or a *Perpendicular*, for *d c* 90 Degrees falls right on *g a*, and makes the Spaces *d c a* and *d c g* equal, *viz.* both 90 Degrees; but after it be passed *d c*, then it is an *Obtuse* or blunt Angle, and contains more than 90 Degrees, 'till it comes to *g c*, which is 180 Degrees, as the Angle *f c a* is 120 Degrees. All which being perfectly understood, will avail much to the understanding of all the Natures of Angles. *Fig. 10.* *Acute Angle.* *Rectangle.* *Obtuse Angle.*

Note, That an Angle is commonly expressed by three Letters, the middle Letter standing at the Angular Point, and the other upon the Sides: And, that

that instead of expressing Degrees and Minutes, &c. at large, I use the Character ° for Degrees, ′ for Minutes, ″ for Seconds, &c. as to set down an Angle of 32 Degrees and 42 Minutes, thus, 32° 42′.

The Measure of an Angle. To measure any Plain Angle is nothing else, but upon the Angular Point to describe a Circle (already divided) or part of it, and see how many Degrees and Minutes it contains, for that is the Measure thereof. As in the Eleventh Figure, suppose the Angle *a b c* was proposed to be measured, or to know how many Degrees and Minutes it contains: Upon the Point *a* I describe Part of one of my divided Circles, and find it 32°. *Fig. 11.*

To lay down an Angle. Likewise if it were required to lay down an Angle of 45° upon the Line *a c*, and upon the Point *a*, I describe Part of my divided Circle, and take with my Compasses the Distance from *c* to 45, and place it from *c* to *b*, then is the Angle *b a c* 45°. *Fig. 12.*

To make one Angle equal to another. And to make one Angle equal to another Angle, is only to make that the same Equal Part of the Circle be contained in them both.

Hence it plainly appears, that let there be never so many Angles set upon one Point of a Line, as at *c*, Figure 13, all will be but two Right Angles, or 180 Degrees. *Fig. 13.*

Head-Angles equal. Likewise if two Lines cross one another, then they make 4 Angles, all equal to 360°, or the whole Circle; and the Cross or Head-Angles are equal, *viz.* *b c a* to *d c f*, and *d c b* to *f c a*, as in the Fourteenth Figure, they containing the same Number of Degrees; as you may prove in the Circle, the Demonstration follows in the Last Part *Fig. 14.*

Prop. IV. *Of Parallels.*

Parallels. PArallel straight Lines in the same Plain are such, as if infinitely continued in the same Plain, would never meet, and 'till we come to the Last Part I shall only illustrate the same with a familiar Example: Imagin that in the Fifteenth Figure, *a b* was parallel to *c d*, then that those two Lines made but one broad Line, then by the last part of the Third Proposition, the Angle *f l b* will be equal to *c h g*, and to *l h d*, and to *a l h*, and so on the other side; so that the altern Angles are equal. *Fig. 15.*

Therefore if *a b* and *c d* be parallel, and from the Point *m* in *c d* two Lines be drawn to the other Parallel *a b*, as at *n* and *o*, there will be five Angles marked on the inside, according to the Figures 1, 2, 3, 4, 5, by the last the Angles 1 and 4 and 3 and 5 will be equal, but the Angles 1, 2, 3, are equal to two Right Angles, and therefore the Angles 2, 4, and 5, will be equal to two Right Angles, or to 180°. *Fig. 16.*

Prop. V. *Of Plain Figures, which are encompassed about with a Line or Lines: As,*

Circle. I. THe *Circle*, whose Superficies or Area is contained within one regular crooked Line, as has been before laid down, to be described from one Center.

Ellipsis. *Fig.* 17.

II. The *Ellipsis*, or regular Oval, described on two Centers, as *a* and *b* in the Seventeenth Figure.

Triangles. *Equilateral.* *Fig.* 18. *Fig.* 19. *Fig.* 20. *Rectangle.* *Fig.* 21.

III. *Plain straight-lined* Figures, as of three Sides and three Angles, called *Triangles*, whereof there are six sorts, three in respect of the Sides, and three of the Angles: As, First, an *Equilateral* Triangle, that has three equal Sides, and three equal Angles, each of 60 Degrees, as in the Eighteenth Figure. Secondly, an *Isosceles* Triangle, that hath two equal Sides and one unequal; as in the Nineteenth Figure, *b c* is equal to *c a*, and *b a* less. Thirdly, all the Sides unequal, called a *Scalenum*, as in the Twentieth Figure. Fourthly, in respect of the Angles, as a *Rectangled Triangle*, that has one Right Angle, as Figure 21, where *a* is the Right Angle, then must the other two Angles at *b* and *c* be both a Right Angle, for by the latter Part of the Fourth Proposition, all the Angles of any Plain Right Triangle are equal to 180°, or two Right Angles, therefore *b* and *c* must be 90°, and from hence the Remainder of the Degrees of any Angle to 90 is called the Complement of that Angle, as if *b* be 50°, *c* will be 40°, so that *c* is the Complement of *b* to 90°. This Note must be remembred, because of great use. Fifthly, all the Angles may be Acute, as in Figure 22, called *Oxigoniums*, where the third Angle is the Complement of the other two to 180°. Sixthly and Lastly, it may be an Obtuse-angled Figure, having one Obtuse Angle, and the rest Acute, called an *Ambligonium*.

Fig. 22. *Acute-angled Triangles.* *Obtuse,*

Squares. *Fig.* 23. *Oblongs.* *Fig.* 24. *Rhombus.* *Fig.* 25. *Rhomboides.* *Fig.* 26. *Trapezes,*

IV. Right-lined Figures, or Superficies, of four Sides, being Quadrilateral, are of five sorts, *viz.* a *Square*, that has four equal Sides, and four Right Angles, as in Figure 23. Or an *Oblong*, Rectangle, or Long Square, that has four Right Angles, and four Sides, whose opposite Sides are equal, as in Figure 24. Or a *Rhombus*, that has all the Sides equal, but the Angles not Right Angles, as in Figure 25. Or a *Rhomboides*, that hath the opposite Sides and Angles equal, but not Equilateral or Right-angled, as in Figure 26: The Oblong and this are called Parallelograms, because two Sides are equal to two Sides, and parallel. Or lastly, all other four-sided Figures are called *Trapezes*; and all Quadrilateral Figures may be divided into two Triangles, by drawing a Line from one Angle to the opposite Angle, which is called the *Diagonal*.

Multilateral. *Polygons Regular.* *Fig.* 27.

V. Other Plain straight-lined Figures, of more Sides than four, are called Multilateral, and takes the Name from the Number of their Sides or Angles, which if they be equal are called Regular *Polygons*; as of five equal Angles, the *Pentagon*; of six, the *Hexagon*; of seven, the *Heptagon*; of eight, *Oxagon*; &c. Now every Multilateral Figure is divided into Triangles, by drawing Lines from corner to corner, and it will have as many Triangles as there be Sides save two, as in Figure 27, of an Irregular seven-sided Figure there will be five Triangles.

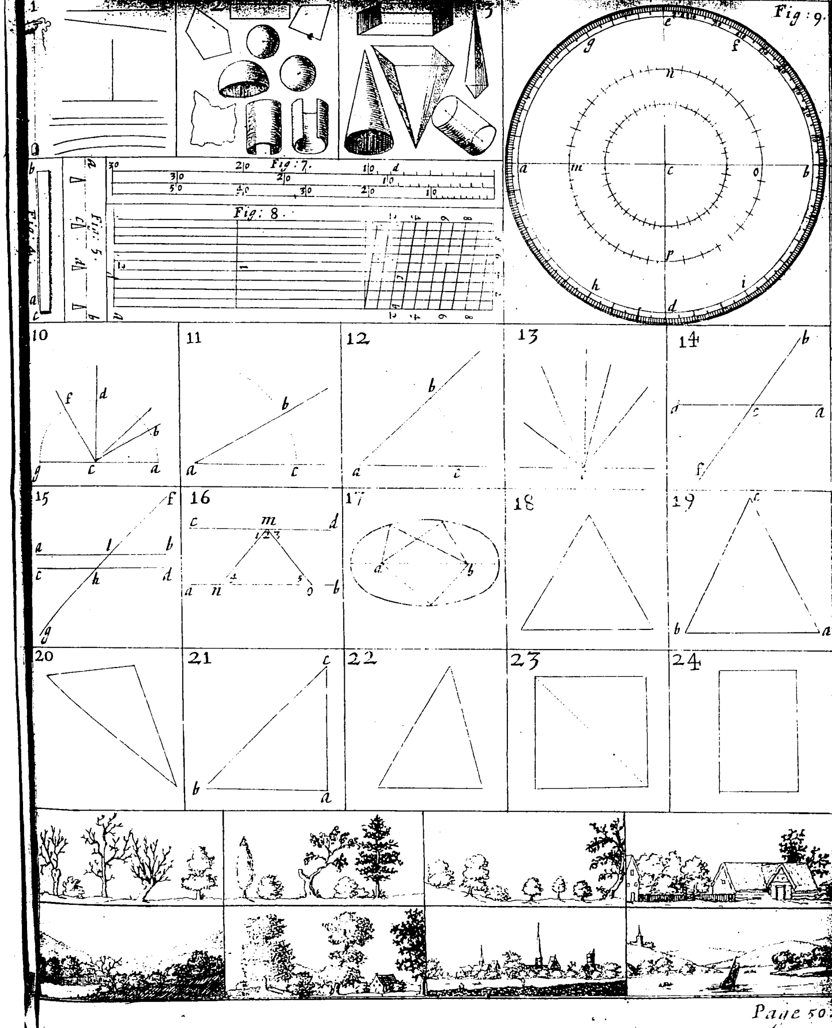
Base,

VI. The Line whereon a Triangle, Square, Oblong, &c. stands on, is called the *Base*.

Height.

VII. The *Height* of any Triangle or Figure, is the Line drawn perpendicular from the Top to the *Base*, as in the Examples following will appear.

Prop.



Prop. VI. *Here follow the Resolutions of certain Geometrical Problems, fitting to be done for several Uses, and for the Exercising the Hand for the Managing of the Ruler and Compasses.*

I. TO raise *Perpendiculars*, either upon Paper or the Ground: As upon the Middle of a Line, Figure 28, at *a*: Take the Compasses, and open them, and set equal Distances from *a* to *b*, and to *c*, then open the Points to a Distance of above *ab* or *ac*, and setting one Foot in *b* make an Arch about *d*, and with that opening, setting a Foot in *c*, cross the former Arch at *d*; then draw *da*, which is a Perpendicular. *To raise a Perpendicular.* *Fig.* 28.

Upon the End of a Line, or near the End, as in Figure 29, by once opening of the Compasses. On the Point *a*, as a Center, describe part of a Circle, *bcd*, with that opening set off the Radius from *b* to *c*, and from *c* to *d*, upon which Points *c* and *d* cross an Arch at *m*; *ma* is a Perpendicular. *Fig.* 29.

Another way, where you may not come so far as *d*, as in Figure 30. Describe the Arch *bc*, and set the Compasses unstirred from *b* to *c*, and setting one Foot in *c* make an Arch at *d*, lay a Ruler by *b* and *c* and cross the Arch at *d*; *da* is a Perpendicular. *Fig.* 30.

Another way, setting the Compasses in *a*, as in Figure 31. Set the other about *c*, and draw the Circle *bad*, and the Diameter *bcd*; then is *da* a Perpendicular. *Fig.* 31.

II. To let fall a *Perpendicular* from a Point above a Line, as at *a*, in Figure 32 Open the Compasses, setting one Foot in *a*, with an Arch cross the Line in *b* and *c*; again with that opening upon *b* and upon *c* cross an Arch at *d*; then is *aod* a Perpendicular. *To let fall a Perpendicular.* *Fig.* 32.

Another way, towards the End of a Line, as at *a* in Figure 33. From *a* draw a Diameter *ab*, which divide in halves at *c*, with the Radius *ca* or *cb* draw the Semicircle *adb*, cutting the Line at *d*; then is *ad* a Perpendicular. *Fig.* 33.

III. To *divide a Line* into two, or into many Parts. First, into two Parts; suppose the Line *bc*, in Figure 28. Open the Compasses to above half, and make the cross Arches at *d* and *n*; the Line *dn* divides *bc* into halves at *a*. *Division of Lines.* *Fig.* 28.

Secondly, to divide a Line into five or more Parts: Raise two Perpendiculars on the Ends of the Line at *a* and *b* contrariwise, as in Figure 34, and set off five Parts on those Perpendiculars, as in the Figure, draw the Diagonal Lines, which will divide *ab* into five equal Parts. *Fig.* 34.

Likewise, by making an Oblong, and dividing of it, as in Figure 35, you may divide all Lines, that will not exceed it, into what Parts you please; which may be done with white Lines that will not deface the Draught, as *ab* to be divided into thirteen Parts, as in the Example. *Fig.* 35.

Angles. IV. To make Angles equal to one another, and to measure and lay them down, was shewn before plainly. The ordinary way, by describing an Angle equal to another by a little Arch, may be easily understood by Figure 36; for upon the Point *a* of the Angle *c a b* you make the Arch *b c*, and not stirring the Compasses upon the Point *d* make an Arch *e f*, taking the opening or distance *b c*, set the same from *f* to *e*, and draw *e f*; then is the Angle *f d e* equal to the Angle *c a b*, having the same Number of Degrees. Fig. 36.

Parallel Lines. Fig. 37. V. Of drawing *Parallel Lines* in the same Plain, which can never meet: For Example, To draw a Parallel to *ab*, at the Distance *c d*; take *c d* in the Compasses, and towards the End of the Line *ab*, as at *m* and *n*, make two Arches, as at *o* and *p*, and by the top of those Arches draw the Parallel Line *o p*.

Fig. 38. But if the Line be *a b* in Figure 38, and the Point *d* be set down, whereby to draw a Parallel Line to it, set the Point of the Compasses in *d*, and take with the other Point the nearest Distance to *a b*, as at *m*, and with that opening towards the other end, as at *n*, make another Arch at *p*, and draw *d p* for a Parallel.

Triangles, Squares, &c. described. Fig. 39. VI. To make an Equilateral Triangle upon a Line given, is done, by taking the Line in the Compasses, and from both Ends describe an Arch, as at *d*, Figure 39, aud draw the Triangle accordingly.

To make a Triangle upon any three Lines given, so that any two may be longer than the third: Lay down any Line of the three, and on the Ends thereof, with those other Lines, make an Arch, as at *d*, in Figure 40, and describe the Triangle. Fig. 40.

Fig. 41. To make a true Square upon any Line given, as upon *a b*, in Figure 41: Upon one End, as at *a*, raise a Perpendicular, as *a c*, take the Length of *a b* in the Compasses, and set it from *a* to *b*, and with that opening, upon the Points *c* and *b*, cross an Arch at *d*; then draw *c d d b* for a true Square.

Fig. 42. To describle a Circle, that shall pass by the three Points *b c d* of the Triangle *b c d*, (or to draw those three Points into a Circle, which is all one) is to cut any two Sides, as *c d* and *b d*, into two equal Parts, by the Third Problem of this Proposition of a *Line*, and draw the Lines 'till they meet, as at *o*, that will be the Center, that the Compasses must be pitched in, to describe the Circle, that will pass by those three Points.

Prop. VII. *Of Solid Bodies, which have three Dimensions, Length, Breadth, and Thickness, and the Extreams are Superficies. The Regular Bodies are,*

Solid Bodies. Sphere. I. THe *Sphere*, which is comprised of one round Superficies, from whence all Lines drawn to the Center are equal, and may be made by a Semicircle turn'd about. These may be round Balls, Globes, &c. Any Diameter may be called the Axis, as *a b*. See Figure 43. Fig. 43.

Spheroid. Fig. 44. II. A *Spheroid*, or long Sphere, is made by the turning the half of an Ellipsis upon his longer Diameter. See Figure 44. The Ends cut off, it makes a Hogshead.

Cylinder. Fig. 45. III. A *Cylinder*, is a Column, or round Pillar, whose Base is a Circle, and is described by a Parallellogram moving upon one of its Sides, as *a b*. See Figure 45.

Cone. Fig. 46. IV. A *Cone*, is a Pyramidal Body that has a Circular Base, and is described by a Right-angled Triangle, as Figure 46.

Cube. V. A *Cube*, is a Body comprised of six Squares, as a Dye. See Figure 47. Fig. 47.

Parallelepipedon. Fig. 48. VI. A *Parallelepipedon*, is a long Body comprehended of six Plain Quadrangles, and has all its Sides opposite and parallel, and equal one to another, as Figure 48.

A Prism. Fig. 49. VII. A *Prism*, is a Solid Body comprehended of many Superficies, two whereof are opposites, equal, parallel, and like, but the rest are Parallelograms. Figure 49.

Pyramid. Fig. 50. VIII. A *Pyramid*, is a Body comprised of many Planes, meeting in one Point at the Top, and having a Plane for its Base. Figure 50.

Regular Bodies. Fig. 51. There are other Regular Bodies, the Number of Five, called *Plato's Bodies*, which may be inscribed in a Sphere, and touch the Superficies, *viz.* (1.) The *Cube*, of 6 Sides, before described. (2.) The *Tetrahedron*, of 4 Sides. (3.) *Octohedron*, of 8 Sides. (4.) *Dodecahedron*, of 12 Sides. And (5.) The *Icosihedron*, of 20 Sides. As the Figures represent, where I have added the Forms of each, which being half cut through with a Penknife will fold up, and make the said five Regular Bodies.

Thus far I have gone in Definitions, and some Practical Rules, for the Use of the Scale and Compass; I now come to the necessary Part of Measuring of Lines, Superficies, and Solids.

Prop. VIII. *The Measure of Lines.*

Measure of Lines. OF Measuring Lines, and of the Common Measures, as Inches, Feet, Yards, Ells, Poles or Perches, Furlongs, and Miles, something has been said already; and now I would have the Boys fully instructed, by Measuring with a Yard or Foot in any Gallery or Room, or elsewhere, what the meaning of a Scale, or of laying down any Measure upon Paper doth signifie. As by the Scales before set down, Figure 7, suppose I measure in some High-way 324 Yards, to lay this down upon Paper, I go, for Example, to my Plain Scale of Ten Parts in an Inch, and set my Compasses in 3 whole Inches (marked 30) and extend the other Point into the small Divisions of an Inch, betwixt *c* and *b*, being 10, to above 2 of them for 20, and almost by Estimation to half the Distance betwixt 2 and 3 of that Scale for 4 at *d*. This being laid down, as in Figure 52, represents the Length of 324 Yards. But if this Scale be found too big, then you may chuse a lesser, of 12, 16, 20, &c. Parts in an Inch, set down in Figure 7 as before, and Plain Scale. Fig. 52.

and this will (by a little Practice) be easily attained, how to measure by any Plain Scale whatsoever.

Diagonal Scale. *Fig.* 53. Yet by these Scales I could not find the 4 part of my Number 324, but by guessing at the fourth part as near as I could; but by the *Decimal Diagonal Scales* you may find that Length exactly. The Scale is described Figure 8, and for the better understanding of those kind of Scales, I have in Figure 53 taken the Tenth part of an Inch, and drawn a Diagonal to divide it actually into Ten parts, and yet by guess you may very near imagin the Spaces to be again divided into other Ten parts, that is, an Inch into 1000 Parts; for Example, if the former Distance 324 were proposed to be taken from that Diagonal Scale N° 8, I go down to 3 on the Scale for 300 at *a*, then upon that Part divided into 10 I seek for 2 at *b*, then I follow that Diagonal of 2 'till I come at 4 of the 10 Lines parallel marked *c*, and extending the Compasses from that Parallel in the Line of 300 at *d* to *c*, that Distance will be equal to 324 Yards, Ells, Feet, or Miles.

If you measure with a Chain or Rod of 10 Foot, or any other Measure, you must be careful to measure in a Right Line, and not to go in or out, which you may do by help of Lines, or small Pins or Pickets, set in the way.

And because several Lines require several Measures, you must know, that in measuring,

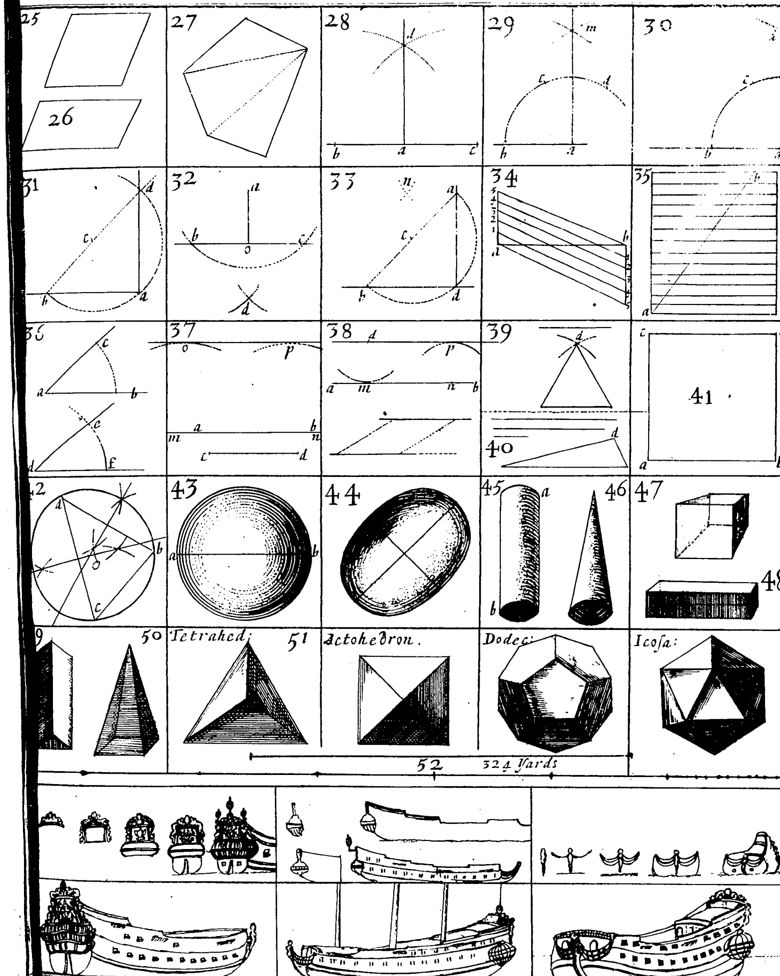
1. Timber, Stone, Earth-work, Gardens, Alleys, Board, Glass, and the like, are measured by the Foot.
2. Land, Woods, Brick-work, &c. are measured by the Perch or Pole.
3. Pavings, Plaisterings, Wainscottings, are measured by the Yard: And so all Linnen and Woollen Cloth, Stuffs, Silks, &c by the Yard or Ell.
4. Tapistry is measured by the Stick of $\frac{3}{4}$ of a Yard.
5. Carpenters Work, as Flooring, Partitioning, Roofing; and so Tiling, Slating, and sometimes the Ground-Plot of Houses and whole Buildings, are measured by a Rod of 10 Foot long, and that every way is called a Square, being 100 square Feet.

Prop. IX. *Measuring of Superficies.*

Measuring of Superficies. TO Measure a Superficies which has two Dimensions, as I said before, is quite otherwise than to measure Lines or Lengths; for as we say, in such a Length there is such a Number of Inches, Feet, Yards, Poles, Miles, &c. so in a Superficies it is said, there is such a Number of Square Inches, Square Feet, Square Yards, Square Perches and Miles; which *Fig.* 54. Squares are the most simple and natural, and so commonly known, and are of two Dimensions, for there being in a Foot 12 Inches, a square Foot is 12 times 12, or 144 square Inches, and there being 3 Foot in a Yard, there are 3 times 3, *viz.* 9 square Feet in a Yard, and so of the rest; which being the only observable Note of this nature, I shall proceed to give the several Rules for Superficies, and then proceed to Solids.

Square. *Fig.* 55. To measure a Square, as suppose the Side be 13 Feet; Multiply the Side by it self, that is, 13 by 13, and it produces 169 square Feet, as in Figure 55.

Plate the 2d



Page 54.

55 But if you should yet desire to know a nearer Measure, as in Inches, then the 13 Feet would be 156 Inches, and that would be in square Inches 24336, which divided by 144, the square Inches in a Foot, gives 169 square Feet; and if any thing remained, it would be square Inches, where 98 would be $\frac{3}{4}$, 72 one $\frac{1}{2}$, and 36 one $\frac{1}{4}$, of a Foot.

To measure an Oblong, or Long Square, is to multiply the Length by the Breadth, suppose that in Figure 56, one Side to be 171 Feet, and the other 56, 171 times 56 will be 9576 square Feet; and if it be desired to know what square Yards there were, divide 9576 by 9, the square Feet in a Yard, and it makes 1064 Yards. *Oblong. Fig. 56.*

The Area of a Rhombus, or Rhomboides, is got by multiplying the Perpendicular P, let fall on one of the Sides, by that Side or Base *b*, as in Figure 57. The Perpendicular is found 82 Yards, and the Side 254 Yards, which multiplied makes 20728 square Yards. But if it be desired to give the Measure in Perches and Acres, because by the Table of *Square Measure*, $30\frac{1}{4}$ Yards go to make a Pole or Perch, (which is $5\frac{1}{2}$ multiplied by $5\frac{1}{2}$ Yards) divide 20728 by 30.25 Yards, and it gives 685 Perches, 6 Feet, and $\frac{3}{4}$ of a Foot; and divide 685 by 160 Perches (for so many are in an Acre) and it gives 4 Acres and 45 Perches, which makes 1 Rood and 5 Perches, which is 4 Acres, 1 Rood, 5 Perches, 6 and $\frac{3}{4}$ Feet, square. *Rhombus and Rhomboides. Fig. 57.*

All other Multangled Figures may be reduced into Triangles, as was before declared.

The Area of any Plain Triangle is gotten, by multiplying the Perpendicular (let fall on the Base) by the Base, and taking half thereof, or by multiplying the Base by half the Perpendicular; or lastly, the Perpendicular by half the Base; for all are the same in the Product. So in Figure 58, the Triangle is *a b c*, the Base *ab* measured to be 264 Perches, and the Perpendicular *c d* 32 Perches, which multiplied make 8448 square Perches, the half whereof is 4224 Perches, and dividing that Sum by 160 (the square Perches in an Acre) it gives 26 Acres, 1 Rood, and 24 Perches. *Triangle. Fig. 58.*

Note, If you had made any other Side for Base, you should have found the same thing, but then you must have prolonged the Base *a c* towards *f*, and *c b* towards *g*, before you could have found the Length of the Perpendiculars *b f* and *a g*; all which will be plain, when you understand the Demonstration thereof in the Last Part.

To measure the Area of a Close or Field, that hath one Side going in and out, as in Figure 59: First, in stead of the crooked Side *c d*, which may be some old River, I draw a straight Line *c d*, which as near as I may judge may take in as much as it leaves out, then I divide this Five-sided Irregular Plot into 3 Triangles, and let fall Perpendiculars from *b* upon the Base *a c*, and from *a* and *d*, upon the Common Base *e c*; then I multiply *a c* by the half of *b f*, and *e c* by the half of *a g* and *b d* added together; those two Products gives the Area in Perches, which divided by 160 gives Acres. *Area. Fig. 59.*

The Area of a Circle, or of any Regular Polygon, is gotten by multiplying half the Circumference by the Radius, or the Perpendicular falling from the Center upon any of the Sides. But because there are certain Pro- *Circles and Polygons.*

portions,

portions, found out by *Archimedes* and others, betwixt the Diameter and Circumference of a Circle, I will set them down, and explain them.

As 7, *to* 22; *so* is the Diameter of a Circle, *to* the Circumference: Therefore, multiply the Diameter given in Length by 22, and divide the Product by 7, the Quotient gives the Circumference. In stead of 7 *to* 22, if you will go nearer and more exact, you may take *Metius* his Proportion, *As* 113 *to* 355; or yet nearer, *As* 1 *to* 3.1415926. But for ordinary use, 7 *to* 22 will be enough.

As 22, *to* 7; *so* is the Circumference of a Circle, *to* the Diameter. Multiply therefore the Circumference by 7, and divide the Product by 22, the Quotient gives the Diameter. So 355 *to* 113; or, *As* 3.1415926 *to* 1, will do the same more exactly.

As 14 *to* 11; or, *As* 1 *to* .785399; *so* is the Diameter squared, *to* the Area of a Circle. Contrary, *As* 11, *to* 14; *so* is the Area of a Circle, *to* the Diameter squared.

As 88 *to* 7; or, *As* 1, *to* .079577; *so* is the Square of the Periphery, *to* the Area of the Circle.

As 1, *to* .707107; *so* is the Diameter, *to* the Root of a Square to be inscribed in a Circle.

As 1, *to* .886227; *so* is the Diameter, *to* the Root of a Square equal to the Circles Area, which is the squaring of a Circle.

And note, That in all these, and the like Rules, where the *Golden Rule* is proposed, by Three Terms to find the Fourth, it is meant, that the Second and Third Terms be multiplied together to make a Dividend, which divided by the First Term gives the Demand.

Thus much for the Area's of Whole and Perfect Circles, now I will shew you, how you may get the Area's of Parts of a Circle, whether it be a Sector or a Segment. A Sector is contained betwixt two Radii, or Semidiameters, and the Arch; a Segment, betwixt the Chord and the Arch.

Fig. 60. Example in Figure 60; *a n b c* is a Sector of a Circle, less than a Semicircle, *a d b c* is a Sector greater: So is *a b n* a lesser Segment, and *a b d a* a greater Segment than a Semicircle.

Sector. To measure a Sector, as *a n b c*, multiply the Radius, or Semidiameter, *a c*, by half the Arch *a b* for the Area; and so of the other Sector in the greater.

Segment. To measure a Segment is more troublesome, for first you must find the Diameter, thus: Divide the Chord *a b* into Halves in *p*, draw a Perpendicular at *p* to *a b*, that shall pass by the Center: Then say, *As n p*, *to p b*; *so* is *p b*, *to p l*: That is, Square the half Chord, and divide it by the *Sagitta n p*, it gives a Number, which added to *n p* gives the Diameter, the half is Radius. Then find the Area of the Sector *a c b n*, and of the Triangle *a b c*, which take from the Sector, and it leaves the Area of the Segment *a b n*. The like Work will find the greater Segment, for the half Chord is a Mean Proportional betwixt the Segments of the Diameter.

Area of the Sphere. The Area of a Sphere or Globe, or any other round Ball, is had, by multiplying the Diameter by the Circumference of the great Circle; or, by

by multiplying the Square of the Diameter by 22, and dividing by 7. For, *As* 7, *to* 22; *so* the Square of the Diameter, *to* the Area.

Cylinder. And, *As* 7, *to* 22; *so* is the Diameter multiplied by the Axis of a Cylinder, *to* the Superficies of the Cylinder.

Cone. And, *As* 7, *to* 22; *so* is the Radius or Semidiameter into the Side of a Cone, *to* the Superficies.

Again, *As* 1, *to* .564189; *so* is the Circumference, *to* the Square Root of a Number equal to the Superficies of a Sphere.

Area of an Ellipsis. To find the Area of an Ellipsis, multiply the longer Diameter by the shorter, and take the Square Root of that Product, which shall be the Diameter of a Circle equal to that Ellipsis. The Area of that Circle is taught before; for, *As* 14, *to* 11; *so* is the Square of the Diameter, *to* the Area.

I will here, to finish this Part of Measuring Superficies, add a few Tables, very little, but exceedingly useful, when occasion requires, for turning lower Denominations into higher; as for Example, to save Division of many Perches by 160 to turn them into Acres, Roods, and Perches, you may enter the following Table with your Perches, and take out the Acres, Roods, and Perches, answering to Thousands under M, to Hundreds under C, and Tens under X.

	M.			C.			X.	
	Ac.	*R.*	*Per.*	*Ac.*	*R.*	*Per.*	*R.*	*Per.*
1	06	1	00	00	2	20	0	10
2	12	2	00	01	1	00	0	20
3	18	3	00	01	3	20	0	30
4	25	0	00	02	2	00	1	00
5	31	1	00	03	0	20	1	10
6	37	2	00	03	3	00	1	20
7	43	3	00	04	1	20	1	30
8	50	0	00	05	0	00	2	00
9	56	1	00	05	2	20	2	10

Example.

Having cast up my Field, I find by computing my Triangles, that I have 7854 Perches, which I set down severally, as follows, and take out of the Table the Parts answering, which make in all 49 Acres, and 14 Perches.

Perch.		*Acr.*	*R.*	*Per.*
7000	=	43	3	00
800	=	05	0	00
50	=	00	1	10
4	=	00	0	04
7854	=	49	0	14

Some-

Sometimes, as in Gardens, Courts, Yards, and other small Places, the Superficies is given in square Feet, which you may turn into Acres, Roods, and Perches, by the adjoyning Table, entring it with the Feet, as you did the last with Perches, and adding them together.

	C M.				X M.				M.		C.	
	Ac.	*R.*	*Per.*	*Feet.*	*Ac.*	*R.*	*Per.*	*Feet.*	*Per.*	*Feet.*	*Per.*	*Feet.*
1	02	1	07	036	00	0	36	119	03	183	00	100
2	04	2	14	171	00	1	33	126	07	094	00	200
3	06	3	21	257	00	2	30	053	11	005	01	028
4	09	0	29	065	00	3	26	252	14	189	01	128
5	11	1	36	150	01	0	23	179	18	099	01	228
6	13	3	03	240	01	1	20	106	22	011	02	056
7	16	0	11	053	01	2	17	033	25	194	02	156
8	18	1	18	140	01	3	13	232	29	106	02	256
9	20	2	25	215	02	0	10	159	33	017	03	084

Example.

Suppose 97642 square Feet be to be turned into Acres, Roods, Perches, and Feet, you will find by the Table, that they make 2 Acres, 38 Perches, and 179 Feet; which must be thus set down.

Feet.		*Ac.*	*R.*	*P.*	*Feet.*
90000	=	2	0	10	159
7000	=	0	0	25	194
600	=	0	0	02	56
42	=	0	0	00	42
97642	=	2	0	38	179

The next Table gives the square Perches, Quarters, and Feet, upon the Face of any Brick Wall measured by a Foot Measure, suppose a Rod of Ten Foot, or otherwise; as for Example: A Wall 68 Foot long and 26 Foot high makes 1768 square Feet, which by the Table gives 6 Perches, 1 Quarter, and 58 Feet. And note, That $272\frac{1}{4}$ square Feet make a Perch, $204\frac{1}{4}$ three Quarters, $136\frac{1}{2}$ half a Perch, and 68 a Quarter. This Measure is for Brick and half, which is 14 Inches, but if the Wall be thicker, account by half Brick, and say, *As* 3, *to* any other Wall in half Bricks; *so* are the Perches and Parts found by Measure, *to* the Perches of that other Wall given in half Bricks.

X M.

	X M.			M.			C.			X.	
	Per.	*Q.*	*F.*	*P.*	*Q.*	*F.*	*P.*	*Q.*	*F.*	*Q.*	*F.*
1	036	2	63	03	2	41	00	1	31	0	10
2	073	1	58	07	1	26	00	2	62	0	20
3	110	0	53	11	0	05	01	0	26	0	30
4	146	3	55	14	2	52	01	1	57	0	40
5	183	2	40	18	1	31	01	3	20	0	50
6	220	1	35	22	0	10	02	0	54	0	60
7	257	0	43	25	2	57	02	2	17	1	02
8	293	3	41	29	1	36	02	3	47	1	12
9	330	2	25	33	0	15	03	1	13	1	22

The following Table is for Measuring Board, Glass, *&c.* by Inches, which will turn square Inches into Feet, Quarters, and Inches; as 9842 square Inches make 68 Feet, 1 Quarter, and 14 Inches.

	M.			C.			X.	
	F.	*Q.*	*In.*	*F.*	*Q.*	*In.*	*Q.*	*In.*
1	06	3	28	00	2	28	0	10
2	13	3	20	01	1	20	0	20
3	20	3	12	02	0	12	0	30
4	27	3	04	02	3	04	1	04
5	34	2	32	03	1	32	1	14
6	41	2	24	04	0	24	1	24
7	48	2	16	04	3	16	1	34
8	55	2	08	05	2	08	2	08
9	62	2	00	06	1	00	2	18

Thus much for the Plain Measure of Area's and Superficies, which if you understand, will be very useful to you; for Example, I demand how many square Miles are upon the Face of the Terraqueous Globe, or whole Earth and Sea? The greatest Circle being 360°, and supposing 60 *Italian* Miles in a Degree, the Circumference will be 21600 Miles, and the Diameter 6873 Miles in a round Number, omitting Fractions; and being shewed in this Proposition, that the Area of a Sphere is found by multiplying the Diameter by the Circumference, multiply the Diameter 6873 by the Circumference 21600, and it gives the Product 148456800 square Miles, the Area required. Now a Mile square being 640 Acres, (for 320 Perches make a Mile, and 320 by 320 gives 102400 square Perches, which divided

I 2 by

by 160 gives 640 Acres) and allowing 20 Acres for a Family of 6 People, a Mile square will maintain 320; then deducting half of the square Miles of the whole Globe for Sea, there remains 74228400 square Miles of Land, which multiplied by 320 gives 23753088000 People, that possibly may live upon the whole Earth; but this Number is far greater than the People living at once, for by *Ricciolus* his Accompt in his *Geography*, they exceed not 1000000000.

Prop. X. *Measuring of Solids.*

Measuring of Solids.

WE are come now to three Dimensions for the Measuring of Solids; and as Superficies are measured by Squares of the same kind, so Solids are measured by Cubes, as Cubick Inches, Cubick Feet, Cubick Yards, Perches, and Miles, a Cubick Inch being commonly the least Measure. If the Side of a Cubick Foot be 12 Inches, to find how many Inches there are in the whole, I multiply 12 by 12, and it gives the square Inches upon the Face of the Cubick Foot to be 144, and then multiplying 144 by 12 for the third Dimension, it gives 1728 Cubick Inches in the Solid Foot: This will appear perfectly in the Cubick Foot Figure 61. Therefore the measuring of a Cube, is to multiply the Side by it self, and the Product by the Side again. And as in the Plain Parallelogram, you may imagin the motion of one Side parallel to the other, to describe all those several Squares that make up that Superficies; so in the Cube, or Parallelepipedon, if you imagin the Superficies A B C D to move through the Solid, it will give you the several Cubes in that Body by that Dimension.

Fig. 61, 62. Cube.

Parallelepipedon. Fig. 47.

The Measure of a right Parallelepipedon, improperly called a long Cube, is to multiply one Side by another, producing the Square at the End, and then that Product by the Length (all those Lines measured making one solid Angle) which produceth the Cubick Feet: As in Figure 47, where the Breadth at the Ends are 1 Foot 4 Inches, and 10 Inches, that is, 16 and 10 Inches, which multiplied make 160 square Inches for the End, and that multiplied by the Length 5 Feet 7 Inches, that is, 67 Inches, makes 10720 solid Inches, which divided by 1728, the Cubick Inches in a solid Foot as before said, it gives 6 Feet solid, and 352 Cubick Inches, which is less than the $\frac{1}{4}$ of a solid Foot, for there being 1728 in a Foot, 1296 solid Inches make $\frac{3}{4}$ of a Foot, 864 the $\frac{2}{4}$, and 432 the $\frac{1}{4}$.

But to avoid these Parts by Inches, it is best to measure with a Foot divided into Ten Parts, and those Parts subdivided into Ten again; for then if you measure either Plains or Solids, the Work will give you Feet, and Decimal Parts of a Foot of the same kind, without any Reduction at all; and in case you have no such Foot by you, then by the Sixth Decimal Table in the *Arithmetick* you may put the Inches and Parts into Decimals, as if it were subdivided; as in the last Example, for 1 Foot 4 Inches I set down 1.333, for 4 Inches by the said Sixth Table gives .333, and for 10 Inches I find there .833, and for 5 Feet 7 Inches I find 5.583; now multiplying 1.333 by .833 it gives Decimally 1.11059, and that by 5.583 gives

gives 6.198, which is 6 Feet and almost $\frac{2}{10}$ of a Foot, which is less than a Quarter.

If you are not minded to work by Decimals, but by solid Inches, then this little Table following will immediately turn the solid Inches into solid Feet, Quarters of a Foot, and solid Inches, by Inspection.

	X M.			M.			C.	
	F.	*Q.*	*In.*	*F.*	*Q.*	*In.*	*Q.*	*In.*
1	05	3	064	00	2	136	0	100
2	11	2	128	01	0	272	0	200
3	17	1	192	01	2	408	0	300
4	23	0	256	02	1	112	0	400
5	28	3	320	02	3	248	1	068
6	34	2	384	03	1	384	1	168
7	40	3	016	04	0	088	1	268
8	46	1	080	04	2	224	1	368
9	52	0	144	05	0	360	2	036

Suppose 11572 solid Inches be to be turned into Feet, entring the Table as directed in the last Proposition, you will find they make 6 $\frac{1}{2}$ solid Feet, and 340 solid Inches, which are less than $\frac{1}{4}$ of a Foot, as in this Example.

Inch.		*F.*	*Q.*	*In.*
10000	=	5	3	064
1000	=	0	2	136
500	=	0	1	068
72	=	0	0	072
11572	=	6	2	340

But if the Parallelepipedon be not right, that one Side be not perpendicular over the other, then must you find the Perpendicular or nearest Distance to the Base, and multiply as before. All Walls, the Dimensions of Rooms, Galleries, &c. are thus measured.

The Measure of Prisms, or the solid Body described before by that Name, is gotten by multiplying the Superficies of the Base into the Height of the Prism; that Superficies of the Base, being to be made of all Plain Figures, is to be gotten as in measuring Superficies; and that Height is to be measured by the nearest Distance of any Part of the Base, continued if need be to the parallel Top. *Measure of a Prism.*

For Example, Figure 63, let the Base of the Prism be *a b c d e f* of six Sides, divide the Superficies thereof (measuring it as in Plains) into 4 Triangles, and 2 Diagonals, by the Decimal Foot, which comes to 7 $\frac{1}{2}$ Feet, that *Fig. 63.*

that is, 7.5, and let the Height bf be 3 and .7 Tenths of a Foot, which multiplied by 7.5 makes 27 solid Feet, .75 Hundred Parts, which is just $\frac{3}{4}$ of a solid Foot.

Measure of a Pyramid.

To measure the Solidity of a Pyramid, is to multiply the Base (which like that of a Prism may be of many sorts of Superficies) into one third part of the Height, which is taken by letting fall a Perpendicular from the Top of the Pyramid to the Base, produced if need be; for a Pyramid and Prism, upon equal Bases and Heights, are as 1 to 3. See the Figures 64.

Fig. 64.

Regular Bodies.

To find the Solidity of the Five Regular Bodies before described: 1. For the *Tetrahedron*, that is, a Pyramid, and last measured. 2. The *Hexahedron*, is the Cube before measured. 3. The *Octohedron*, thus measured, Multiply the Square of one of the Sides into $\frac{1}{3}$ of the Distance of any two Corners, and the Product is the Solidity; for it is but two Pyramids upon a square Base. 4. The *Dodecahedron* is only 12 Pyramids, whose Base is a Pentagon, and Top the Center, therefore multiply the Base into $\frac{1}{3}$ of the Height to the Center 12 times, which is the Solidity of the whole: And to find that Height, take the Distance of two parallel Faces, the half is the Height. 5. The Solidity of the *Icosihedron* consists in 20 several Pyramids, whose Bases are Triangles, that is, its Faces, the Height is the half Distance of two equidistant Faces; multiply the Triangle, which is the Base, by $\frac{1}{3}$ of the Height, and that taken 20 times makes the Solidity.

Irregular Solid Bodies of Plain Faces.

Now even as these last Regular Bodies are measured by the Number of Pyramids contained in them, even so all Irregular Plain Solids may be divided into so many Prisms and Pyramids, as Plain Figures into Triangles, and then measured as before.

To measure Cylinders, or Columns. Fig. 65, 66.

Multiply the Base (that is, the Area of a Circle, taught before) by the Height of an *upright Cylinder*, or by the Perpendicular of a *sloping* one, and the Product gives the solid Content, as in the Figures 65 and 66.

Trunks of Cylinders. Fig. 67.

Thus are *round Columns*, Trees (commonly measured in the middle) and all other such Figures measured. But if it be a *Trunk* of a right Cylinder, obliquely cut off, as in Figure 67; to deal with this Trunk, draw by the Point C a parallel Circle to the top, and divide MD into halves, then measure $abkg$ as a Cylinder by it self.

Cone. Fig. 68.

The Solidity of a *Cone* is gotten, if you multiply the Base by one third of the Height; the Height is found as you may see by Figure 68.

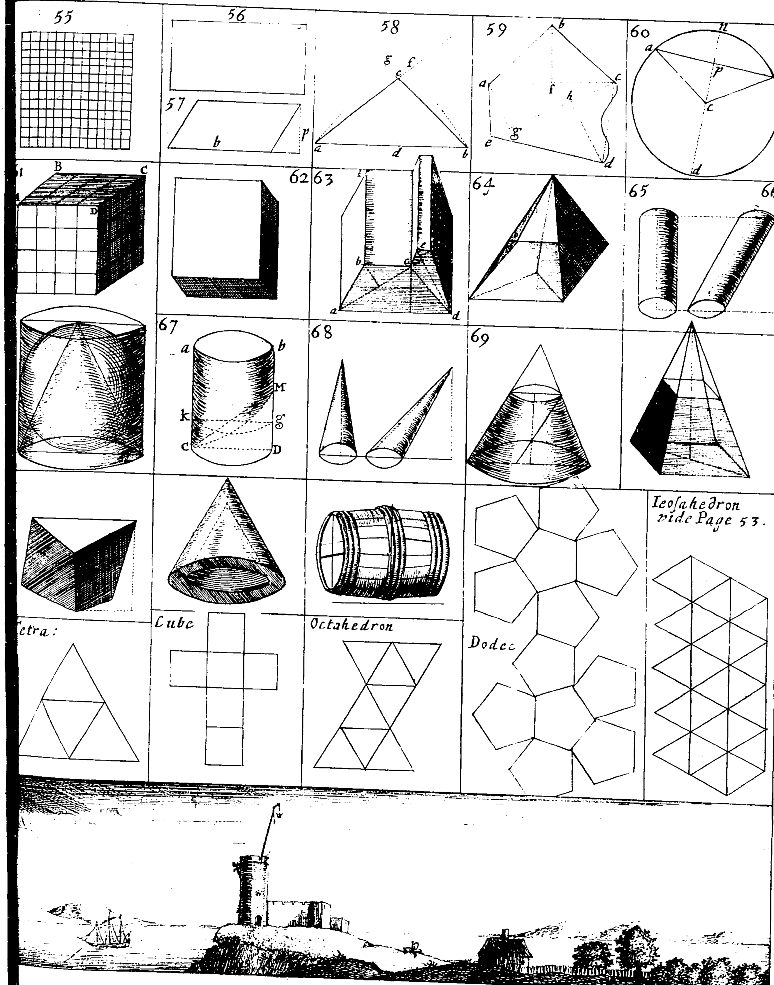
Trunk of a Cone. Fig. 69.

To measure the *Trunk* of a *Cone*, or a Cone cut off, as in Figure 69, first take the Diameters at both Ends of the Trunk, and the Height, then say, *As* the Difference of Diameters, *to* the lesser Diameter; *so* is the Height of the Trunk, *to* another Number, which is the Height of a Cone that will supply the Trunk; so have you two Cones; and if you take the lesser out of the greater, it leaves the Solid of the Trunk required.

Sphere.

The Solidity of the *Sphere* is found, by multiplying its Superficies (taught before) into one third part of the Radius or Semidiameter, or one sixth of its Diameter. I will give you some few Proportions, that concern the Solidity of Spheres, Cylinders, Cones, &c. as follows.

As 14, *to* 11; or, *As* 1, *to* .785399; *so* is the Square of the Diameter mul-



Page 62

multiplied by the Side of the Cylinder, *to* the Solidity of the Cylinder: And, *so* is the Diameter squared, multiplied by one third of the Axis, *to* the Solidity of the Cone.

As 1, *to* .523599; *so* is the Cube of the Diameter, *to* the Solidity of the Sphere.

As 1, *to* .016887; *so* is the Periphery cubed, *to* the Solidity of the Sphere.

As 42, *to* 22; or, *As* 1, *to* .5236, *so* is the Diameter cubed, *to* the Solidity of the Sphere.

A *Cone*, a *Sphere*, and a *Cylinder*, that have the same Heights, and Diameters of the greatest Circles equal, are as 1, 2, 3.

Measuring of Ships.

For the Measuring of Ships, it will be found a very difficult matter to do it truly, the Body within being so irregular, however it will be requisit to set down the way that Ship-Masters and Carpenters generally use for the Measuring the Tunnage of a Ship, *viz.* They multiply the Length of the Keel, the Breadth of the Midship-Beam, and the Depth of the Hold, one into another, and divide the Product of those three Numbers by 100, the Quotient gives you the Tuns of that Ship: And this is the Measure His Majesty gives for Merchant-Men for the Wars. But where there is no Allowance for Guns, &c. divide by 95, and the Quotient gives the Tunnage; Example, A Ship is 60 Foot by the Keel, the Breadth is 20 Foot, and 11 Foot deep in the Hold; I multiply 60 Feet by 20, and it gives 1200, which multiplied by 11 gives 13200 solid Feet, I divide that by 100, and it gives 132 Tuns for the Measure of that Ship; but if divided by 95, it will give 138 Tun, and almost an half, for Merchant-Men. *Measuring of Ships.*

Gauging of Vessels.

The Gauging of Vessels (or all manner of Cask) may be required from you, therefore you must know, that the *Gallon* (which is the Common Measure for this Work) is of several Dimensions, for several Measures are now allowed and used: A Gallon for Dry Measure contains 272 Solid Inches, for Wine 231, and for Beer and Ale 282. The three following Tables are made for converting any Number of Solid Inches, whether of Corn, &c. or liquid Substance, into Gallons; the first for Dry Measure, the second for Wine, and the third for Beer and Ale. *Gauging.*

There being 272 Solid Inches in a Gallon for Dry Measure, 34 Solid Inches will stand for a Pint; and 29 for a Wine Pint, and 35 for Beer or Ale.

The Use of these Tables is to cast up what quantity of Gallons, Pints, and Inches, are in any Number of Solid Inches, found in the Measure of any Cask or other Vessel, either for Dry Measure by the first, for Wine by the second, or for Ale and Beer by the third. Let one Example serve for all. Suppose 9845 Solid Inches were found to be contained in a Cask of

Wine,

Wine, take out of the second Table 9 M. 8 C. 4 X. and to them add the 5, and you will find the Content to be 42 Gallons, 4 Pints, and 26 Inches; and the like Work for the rest.

Inch.		*G.*	*P.*	*In.*
9000	=	38	7	20
800	=	3	3	19
40	=	0	1	11
5	=	0	0	5
9845	=	42	4	26

Table I.

Solid Inches turned into Dry Measures.

	XM.			M.			C.			X.	
	G.	*P.*	*In.*	*G.*	*P.*	*In.*	*G.*	*P.*	*In.*	*P.*	*In.*
1	036	6	04	03	5	14	00	2	32	0	10
2	073	4	08	07	2	28	00	5	30	0	20
3	110	2	12	11	0	08	01	0	28	0	30
4	147	0	16	14	5	22	01	3	26	1	06
5	183	6	20	18	3	02	01	6	24	1	16
6	220	4	24	22	0	16	02	1	22	1	26
7	257	2	28	25	5	30	02	4	20	2	02
8	294	0	32	29	3	10	02	7	18	2	12
9	330	7	02	33	0	24	03	2	16	2	22

Table II.

Solid Inches turned into Wine Gallons.

	XM.			M.			C.			X.	
	G.	*P.*	*In.*	*G.*	*P.*	*In.*	*G.*	*P.*	*In.*	*P.*	*In.*
1	043	2	09	04	2	18	00	3	13	0	00
2	086	4	18	08	5	07	00	6	26	0	20
3	129	6	27	12	7	26	01	2	11	1	01
4	173	1	08	17	2	15	01	5	24	1	11
5	216	3	17	21	5	05	02	1	09	1	21
6	259	5	16	25	7	23	02	4	23	2	02
7	303	0	06	30	2	12	03	0	06	2	12
8	346	2	16	34	5	03	03	3	19	2	22
9	389	4	25	38	7	20	03	7	05	3	03

Table

Table III.

Solid Inches turned into Beer and Ale Gallons.

	CM.			XM.			M.			C.			X.	
	G.	*P.*	*In.*	*G.*	*P.*	*In.*	*G.*	*P.*	*In.*	*G.*	*P.*	*In.*	*P.*	*In.*
1	0354	4	31	035	3	24	03	4	13	0	2	29	0	10
2	0709	1	27	070	7	13	07	0	26	0	5	23	0	20
3	1064	2	23	106	3	02	10	5	03	1	0	18	0	30
4	1418	3	19	141	6	26	14	1	16	1	3	12	1	04
5	1773	4	15	177	2	15	17	5	29	1	6	05	1	14
6	2128	5	11	212	6	04	21	2	07	2	1	00	1	24
7	2582	6	07	248	1	28	24	6	20	2	3	30	1	34
8	2836	7	03	283	5	17	28	2	33	2	6	24	2	08
9	3191	7	34	319	1	06	31	7	11	3	1	18	2	18

Thus for all Bushels, Pecks, and other Measures, whether Dry or Wet, that are like Cylinders, get the Area of the Circular Base in Inches, and multiply the same by the Height in Inches, it gives the solid Content in Inches, which the foregoing Tables will turn into Gallons and Pints of *Winchester* Measure.

And for obtaining the Circular Base or Area, say,

As 1, *to* .78539; *so* the Diameter squared, *to* the Area.

Or more easily by the Logarithms, thus; Add the Logarithm of the Diameter doubled, to the Logarithm $\bar{9}$,895085, and it gives the Area desired, which added to the Logarithm of the Height, gives the Content in Inches; and if the Tables be not at hand, you may divide those Inches by the solid Inches in a Gallon of that Liquor, and it gives the Content in Gallons.

But in measuring the Spheroid or Hogshead, or Vessels that are so figured, you must take the Diameters at the Boung and Head, and by them get the Area's by the last Rule; then take two thirds of the Area of the Circle at the Boung, and one third of the Area at the Head, and add them together, multiply the Sum by the Length of the Vessel, and the Product gives the Solidity in Inches, which being turned into Gallons by either of the former ways, gives the Content in Gallons and Pints.

Or if you use this Proportion,

As 1, *to* .5236; *so* the Diameter squared, *to* $\frac{2}{3}$ of the Area.

And,

As 1, *to* .2618; *so* the Diameter squared, *to* $\frac{1}{3}$ of the Area.

Or, if by the Logarithms, for $\frac{2}{3}$ you use $\bar{9}$,718999, for $\frac{1}{3}$ $\bar{9}$,417969; it will give the Area's as before.

If you would measure by a Gallon-Rod, so divided as it will find the Gallons and Parts in any Vessel or Cask; take the Cube Roots of 272.25 for Dry Measures, of 231 for Wine, and 282 for Beer and Ale, which are 6.481, 6.134, 6.557, and measuring the same on a Ruler of Inches, take them exactly off, and place them on some Rule severally, and divide that into 100 Parts, and so let the Ruler be divided the Length of a But or Tun, every one of those will be Gallons and 100 Parts, and whatever you measure with this Ruler, after Multiplication, all the Integers will be Gallons, and the rest Decimal Parts; which will be very useful in Gauging.

CHAP.

CHAP. III.

Of TRIGONOMETRY, *or Measuring of Plain Triangles, Taking Heights, Depths and Distances, Levelling, &c.*

PREFACE.

This Chapter treats of the Analysis *or Resolution of Plain Triangles, and you are not only to consider Triangles drawn before your Eye on Paper, but also those that are conceived to be made on the Ground, in the Air, upon the Sea or Waters, or in the Heavens: And because this Doctrin is of great use, and ought in all its Parts to be perfectly understood, I will therefore take more than ordinary pains to explain and accommodate it to your tender Years and Capacities, desiring you not to slip any part of this Chapter, but perfectly to understand it; and though I cannot say it is perfectly demonstrated, 'till you come to the Last Part, yet I have illustrated it, and explained it so to the full, that you will perceive the Reasons of it very plainly, and with much delight. But before I proceed to the Rules, these General Notions are to be understood.*

SECTION I.

Of Definitions, and Notable Propositions, belonging to Trigonometry.

I. *TRIGONOMETRY* is the Doctrin of *Measuring Triangles.*

II. A *Triangle* is a Figure comprehending three Angles by three Sides, as in the Figures 1, 2, 3, 4. Fig. 1, 2, 3, 4.

III. A *Triangle* may be described either upon a *Plain* Superficies, or a *Spherical* or *Globous*.

IV. A Triangle described upon a Plain Superficies is called a *Plain Triangle*, as the two first Figures (1, 2.) BAC and BCD; and this kind of Triangle is always Right-lined.

V. A Triangle described upon a Spherical Superficies, or Globe, is called a *Spherical Triangle*; and such are resembled in the Figures 4, 5. by the Letters *b a c* and *b c d*, and the Sides of these Triangles are always Spherical or Crooked, being Parts of the greatest Circles upon the Sphere or Globe.

VI. In every Triangle, both Plain and Spherical, any two Sides are called the *Legs* of the Angle, comprehended or contained by them; and the third Side is called the *Base* of the said Angle, as in the Triangle
Fig. 1. ABC (Figure 1.) the Sides BC and CA are the comprehending Sides, or the Legs of the Angle C, and the third Side BA is the Base of the said Angle C.

VII. In every Triangle, both Plain and Spherical, every Side is said to *subtend* or *lye under* the Angle opposite to it; as in the Triangle ABC
Fig. 1. (Figure 1.) the Side BC subtendeth the Angle A; and the Side BA subtendeth the Angle C, and the Side CA the Angle B.

VIII. In one and the same Triangle, whether it be Plain or Spherical, greater Sides subtend greater Angles, and equal Sides subtend equal Angles.

IX. The Measure of an Angle is the Arch of a Circle, described on the Angular Point, and intercepted between the comprehending Sides,
Fig. 5. being sufficiently produced: As in the Triangle BAC (Figure 5.) the Measure of the Angle ABC is the Arch CH, intercepted between the Sides BC and BA, extended to H. This I should not have repeated, because the same was said before in the last Chapter, which I desire you to call to mind, for this is especially to be noted.

X. Every Circle, as was there taught, is divided into 360 Parts, which are called *Degrees*, and every Degree is divided into 60 Parts called *Minutes*, and every Minute into 60 Parts called *Seconds*, &c. in the sexagenary Progression; but better it were to divide the Degree into Ten Parts, and every Tenth Part into Ten again, &c. in the decimal Progression; but because this Progression is not generally used, I proceed upon the former.

Fig. 5. XI. Therefore a *Quadrant* (or Quarter of a Circle) is 90 Degrees, as the Arch DH: And the Complement of an Arch lesser than a Quadrant, is

is that which it wanteth of a Quadrant; as the *Complement* of the Arch CH (supposing CH 20°) is the Arch CD 70°, which together make 90°.

XII. *Vertical Angles*, or those Angles which are opposite cross-wise, are equal: As CBH and EBF are equal both to 20°, and likewise the Angles CDE and HBE are equal both to 70°.

XIII. Angles, as was shewed in the foregoing Chapter, are either Right Fig. 5.
or Oblique; a Right Angle hath a Quadrant, or 90 Degrees, for its Measure, as DBH; an Oblique Angle is either Acute (or sharp) as CBH 20°, always less than 90°, or Obtuse (or blunt) which is always greater than a Quadrant, as CBE, which is 160°, that is, DBC 70°, and DBE 90°.

XIV. Many Right-lined Angles, concurring in a Point of a Right Line Fig. 5.
extended on both Sides, being all taken together, are equal to two Right Angles, or to 180 Degrees; as the Angles HBC, CBD, and DBE, concurring in the Point B upon the Right Line EH, are equal to two Right Angles, HBD and DEB.

XV. If a Right Line AB fall upon the Right Parallel Lines CD and Fig. 6.
EF, it maketh the Angles which are alike placed to be equal, and also the Angles that are alternately placed to be equal, and contrariwise; as the Angles BHD and BGE, which are alike placed, are equal; and again, CHG and HGF, which are alternately placed, are so likewise; and so of the rest; for this I shewed before would follow, because Parallel Lines are as it were one Broad Line.

XVI. Every Triangle, whether Plane or Spherical, is either Right-angled or Oblique.

XVII. A *Right-angled Plain Triangle* is that which hath but one Right Angle; and in such, the Side that subtends the Right Angle is in an especial manner called the *Hypothenuse*, (or Subtense) and one of the Sides, including or containing the Right Angle, is called the *Cathetus* or Perpendicular, and the other is called the *Base*, as in Figure 1. According to Mr. *Oughtred's* Directions, every Right-angled Triangled is to be fitly noted with Fig. 1.
the Letters ABC, so that BA may be the *Base*, CA the *Cathetus*, and BC the *Hypothenuse*; and again, that B may be the Angle at the Base, C the Angle at the *Cathetus*, and A the Right Angle; as you may see in the Figures 1, 2.
Fig. 1, 2.

XVIII. An *Oblique-angled Triangle*, is that which hath all its Angles Fig. 2 & 4.
Oblique, and this is most fitly noted with the Letters BCD; and whether this Triangle be Plain or Spherical, it is reduced into two Right-angled Triangles, by a *Perpendicular* let down from any Angle upon any Side made the Base, extended if need be, which *Perpendicular* will fall either within the Triangle,

Triangle, (when the Angles at the Base are of the same kind, that is, both Acute or both Obtuse, as it may fall out sometimes in Spherical Triangles,) or else without the Triangle, if the Angles at the Base be of divers kinds, (the one Acute, the other Obtuse,) on that part always where the Obtuse Angle is made; as you may see in the following Triangles.

Fig. 7, 8, 9, 10, 11, 12. 1. Note, That the Angle from which you let down the Perpendicular may be marked with the Letter C, and the End of the Perpendicular (touching the Base BD) with the Letter A, and so the Perpendicular of both Right-angled Triangles, into which the Oblique-angled Triangle is reduced, will be CA, and their Bases BA and DA, which Bases may be called Cases.

Fig. 8, 9, 11, 12. 2. Note, That the Base of the Oblique-angled Triangle BD, is either the Sum of the Cases, as in Figures 6 and 10, BD is equal to BA and DA; or else, it is the Difference of the Cases, as in the four other Triangles in the Figures 8, 9, 11, and 12; and, that either BD is equal to DA, less by BA, as in the Triangles in the Figures 8 and 11; or BD is equal to BA, less by DA, as in the Figures 9 and 12.

Fig. 13. XIX. In a Plain Triangle, a Line drawn parallel to the Base, cutteth the Legs proportionally, 2 *P.* 6 *Euclid:* As in the Plain Triangle BAC, if HI, a Parallel to the Base BA, cut off a third part of the Side CA, it will also cut off a third part of the Side BC; and therefore it will be,

As CA . CI :: BC . CH And :: IA . HB

The reason is, because the Parallel Line cutteth all Right Lines drawn through the whole Space DELK, in such proportion, as it self cutteth the same Space.

XX. If there be two or more Plain Equi-angled Triangles, (that is, such as have the three Angles of one equal to the three Angles of the other, each to its respective Angle,) then have they the Sides about the Equal Angles proportional, 4 *P.* 6 *Euclid.* This being the chief Foundation of all Trigonometry, is most diligently to be regarded.

To explain it, let the Plain Triangles *bcd* and BCD be Equal-angled, so that the Angle *b* be equal to B, the Angle *c* equal to C, and the Angle *d* equal to D; then the Sides about the Equal Angles will be proportional, thus:

1. *As* *bd* . *bc* :: BD . BC
2. *As* *bc* . *cd* :: BC . CD
3. *As* *cd* . *db* :: CD . DB

The reason is this, because the Angle *b* of the little Triangle is equal to the Angle B of the greater Triangle; therefore if *bd* be applied to BD, the Side *bc* will of necessity fall upon the Side BC. Again, because the Angle at *c* is equal to the Angle at C, and the Angle *d* equal to the Angle D, therefore when the little Triangle *bdc* is fitted into the greater BDC, the Side *cd* will be parallel to the Side CD; and according to the Proposition next before-going, the Sides of the greater Triangle BCD are cut proportionally by the Side *cd*, therefore,

As B*d* . B*c* :: BD . BC

Which is the first Proportion, and the same will follow in the other two, by fitting the little Triangle upon any of the Angles of the greater that is Equi-angle.

XXI. If any Side of a Plain Triangle be produced, or continued forth, the outward Angle made by that continuation, is equal to the two inward and opposite Angles, 32 *P.* 1 *Euclid:* As if the Side BD of the Triangle BCD be continued to G, the outward Angle CDG will be equal to the inward and opposite Angles at B and C; for if DF be drawn parallel to BC, then will the Angle CDG be equal to the Angles CDF and FDG, because Parts But by Proposition XIV. of this Section CDF is equal to C, and FDG equal to B; therefore CDG is equal to C and B.

XXII. In every Plain Triangle, the three Angles are equal to two Right Angles, that is to say, to 180 Degrees; as in Figure 16, the Angle B, more C, more the Angle BDC, are equal to 180 Degrees; for the Angles B, C, and BDC, are equal to the Angles FDG, CDF, and BDC, by the last Proposition, which all concur in one Point at D, and are all equal to two Right Angles, or 180°: Therefore, Fig. 16.

1. In a Plain Triangle there can be but one Right or Obtuse Angle.
2. If one Angle in a Plain Triangle be either Right or Obtuse, then the other two of necessity must be Acute.
3. If one Angle in a Plain Triangle be Right, then of the two Acute Angles remaining, the one is the Complement or Remainder of the other to 90 Degrees.
4. In any Plain Triangle, if one Angle be subtracted from 180 Degrees, there will remain the Sum of the other two; or if the Sum of any two Angles be subtracted from 180°, the Remainder is the third Angle.
6. If two Plain Triangles have two Angles equal either to other, then the third Angle of the one is equal to the third Angle of the other; and so both the Triangles are Equi-angled.

XXIII. If a Plain Triangle be inscribed in a Circle, every Angle is half of the Arch opposite to it, 20 *P.* 3 *Euclid:* As the Triangle BCD, Figure 17, being inscribed in a Circle, if the Arch BD be 70°, the Angle at C is 35°, *viz.* half the Arch BD; for the Angle at the Center BED is double to BCD, in what part of the Circle soever it is made. The same will happen, if the Center of the Circle falls without the Triangle, as in Figure 18; for the Angle DEB is twice the Angle BCD; and so of the rest. Fig. 17. Fig. 18.

1. Note, That if upon the Angular Point of any Triangle, as of ABC at B, there be three Circles, or more, drawn one bigger than another, the Fig. 19.

the lesser Circle is equally a Measurer of that Angle B with the other greater Circles; for the lesser is as great a part of his Circle, as the greater of his; but this was intimated before.

2. Note, That for any thing said *to be given*, is the same as *to be known*.

XXIV. In all Plain Right-angled Triangles, one of the Sides may be conceived the Radius or Semidiameter of a Circle, and may be expressed by some Quantity, the other two Sides are expressed in Parts of the first, for all the Varieties of the Acute Angles: See those Tables, which are fitly by some called *Canons of Triangles*, and by others, *Canons* or *Tables of Sines, Tangents, and Secants.*

And since it is very requisite, that the Nature of *Sines, Tangents,* and *Secants*, be throughly learned by him that intends to study *Trigonometry*, I shall set down their Description in the next Section.

SECTION II.

Propositions, shewing the Nature of Sines, Tangents, and Secants, both in Lines, Numbers, and Logarithms.

Chord.

I. IF a Right Line divide a Circle into two Parts or Segments, that Right Line is called a *Subtense* or *Chord*, (or *String*,) and that part of the Circle which it subtendeth (or lyeth under) is called the *Arch* or *Bow* of the said Subtense or Chord: As in the Circle, Figure 20, K C is a Subtense or Chord, (or String,) and K E C or K F G H *a* C is the Arch or Bow thereof; so F *a* is a Subtense or Chord, and F K E C A or F G H *a*, either of them, the Arch of the same Chord: And so again C H is a Chord, and its Arch is C *a* H, or C E K F G H.

Fig. 20.

II. A *Subtense* or *Chord*, when it is greatest, divideth the Circle into two equal Segments, and subtendeth a Semicircle (or Half-circle or 180°) on either Side; as the Right Line F *a*; and this is commonly called a *Diameter.*

III. Half of this Diameter is called the *Radius*, which signifieth a Sun-Beam or Spoke of a Cart-wheel, unto either of which, the *Radii* of Circles bear a very fit resemblance, issuing from the Center unto the Circumference; as the Right Lines BF, BE, BC, B *a*, BH, and BG

IV. A *Subtense* or *Chord*, not greatest, is that which divideth the Circle into two unequal Segments, and therefore it subtendeth on the one side an Arch less than a Semicircle, and on the other side an Arch greater than a Semi-

Semicircle: As the Right Line CH, subtending the Arch C *a* H less, and the Arch CIH greater than a Semicircle.

V. If a *Diameter* cut a *Subtense* or *Chord* at Right Angles, it cutteth it also into two equal Parts, and it cutteth also the Arch subtended by that Chord into two equal Parts: As the Diameter F *a*, cutting the Chord C H at Right Angles in the Point A, cutteth it also into two equal Parts or Halves in the same Point; it cutteth also the Arch C *a* H into two equal Parts in the Point *a*, and the Arch C F H into two equal Parts at F.

VI. Half of the Chord thus Divided, is called *Sinus Rectus*, or the *Right Sine* of that Half of the Arch so cut by the Diameter it subtendeth. Thus C A is the Right Sine of the Arch C *a*, and also of the Arch C E F; and likewise A H is the Right Sine of the Arch *a* H, and also of the Arch H G F. Hence it followeth: *Right Sine.*

1. That the *Right Sine* of an Arch, less than a Quadrant, and of its Complement to a Semicircle, is one and the same Right Line; as the Right Sine of the Arch C *a* and C E F, is the same Right Line C A.

2. And therefore when we say, the *Right Sine*, or the Sine of the Complement of an Arch, we mean, the Right Sine of the Complement of the Arch less than a Quadrant, that is, the Complement or Remainder unto a Quadrant or 90°, and not unto a Semicircle: As the Right Sine of the Complement of the Arch C *a*, namely, of the Arch it self C E, is the Right Line C I.

3. The *Right Sine* of the Complement of an Arch, is equal to that Part of the Diameter or Radius, which is intercepted betwixt the Right Sine of the Arch and the Center of the Circle: As the Right Sine of C E (being the Complement of C *a*) namely, the Right Line C I, is equal to the Right Line A B.

VII. That Part of the Diameter, dividing the Subtense or Chord, which is intercepted between the Right Sine and the Circumference, is called *Sagitta* (an Arrow) or *Sinus Versus*, the *Versed Sine*: As A *a* is the *Sagitta*, Arrow, or Versed Sine of the Arch C *a*; and so is F A the Versed Sine of the Arch C E K F. *Versed Sine.*

VIII. Therefore, taking the Right Sine of the Complement of an Arch from the Radius, it leaves the Versed Sine of the same Arch: As B *a* Radius, less by B A, the Sine Complement of C *a*, leaves C *a*, the Versed Sine of C *a*. And so the Right Sine of the Complement of an Arch, being added to the Radius, gives the Versed Sine of the same Arch.

IX. If a Right Line, touching a Circle at the one End of an Arch, meet with the Radius produced at the other End of the Arch, it is called, the *Tangent* of the Arch thus bounded; and the Radius so produced to the Tangent is called the *Secant* of the same Arch, because it cutteth through the *Tangent. Secant.*

the Circle: As the Line ac is the Tangent of the Arch aC, and the Line Bc is the Secant of the same Arch aC; so likewise ED is the Tangent of the Arch EC, and BD is the Secant of the same Arch.

X. The *Radius*, the *Right Sine*, and the *Right Sine* of the *Complement* of any Arch, make a Plain Right-angled Triangle, as BAC; and the *Radius*, the *Tangent*, and *Secant* of the some Arch, make another Right-angled Triangle, Equal-angled, or like to the former, as the Triangle Bac: And lastly, the *Radius*, the *Tangent* of the *Complement* of the same Arch, and the *Secant* of the Complement of the same Arch, make another Triangle, Equal-angled, or like to both the former, as the Triangle BED.

Hence, by the former Proposition of Equi-angled Triangles, by comparing one Triangle with another, and taking the Sides about the Equal Angles, will follow these Propositions, between the *Radius*, the *Sine*, *Tangent*, and *Secant*, of one and the same Arch; and the *Sine*, *Tangent*, and *Secant*, of the *Complement* of the same Arch; thus:

1. *As* Sine Complement, *to* Sine; *so* Radius, *to* Tangent. Because,
BA . CA :: Ba . Ca
2. *As* Radius, *to* Sine; *so* Secant, *to* Tangent. Because,
BC . CA :: Bc . ca
3. *As* Sine, *to* Radius; *so* Radius, *to* Secant Complement. Because,
CA . BC :: BE . BD
4. *As* Tangent, *to* Radius; *so* Radius, *to* Tangent Complement. Because,
ca . Ba :: BE . DE

XI. The *Diameter*, the *Chord* of an Arch, and the *Chord* of the Complement of the same Arch to a Semicircle, make a Right-angled Triangle, as FCa; and the *Sine* of the same Arch is always a Perpendicular, drawn from the Right Angle of the said Triangle upon its Base, as the Sine CA; and therefore (by 8 *P*. 6 *Euclid*) there are three Right-angled Triangles, all Equi-angled, or like one to another, as the three Triangles FCa, FAC, and CAa. Hence it followeth, by comparing those Triangles.

1. *As* Sine Versed, *to* Sine; *so* Sine, *to* Sine Versed of the Complement to 180 Degrees. Because,
FA . CA :: CA . Aa
2. *As* two Radii, *to* Chord; *so* Chord, *to* Sine Versed. Because,
Fa . Ca :: Ca . Aa

Description of the Lines upon Paper.

XII. Having hitherto treated of these Lines in general, I come now to shew how they may be described upon Paper severally, *viz*. the Lines of *Chords*, *Sines*, *Tangents*, and *Secants*. And first of the Chords.

Fig. 21. Line of Chords.

1. Form the general Figure 21, and divide the Circle (as you have been before taught) into four Quarters or Quadrants, *viz*. M, N, O, V, by crossing the Center C with two Diameters at Right Angles, *viz*. AB and PQ; divide each Quadrant into 90 Degrees, and number them as in the before-mentioned Figure, that is, the Quadrants M and N from A and B toward Z into 90 Degrees each, and the Quadrants O and V into 90 Degrees each from P; then to describe a Line of Chords of 90 Degrees, draw the Chord of 90 Degrees from P to B in the Quadrant V, and setting one Foot of your Compasses in P, extend the other from Degree to Degree, through all the 90 Degrees of the Quadrant V, in the Circle PB, keeping that in the Point P fixt, and transfer them all into the Chord-Line PB, as they are actually done in the Figure for every 10 Degrees, and number them from P to B, thus, 10, 20, 30, &c. Now it is plain, that this Line is a Line of Chords, all the Chords being actually transferred into it. And because a Line of Chords of 60 Degrees will many times be sufficient for use, you have the same described from P to Q in the said Quadrant V. And these Lines, for a greater or lesser Circle, may be thus divided, and placed upon some Ruler, or otherwise, as you see below in pb and pq. Note, that pq is always equal to the Radius or Semidiameter, by which it was made.

Line of Sines. Fig. 21.

2. The Line of *Sines* being always equal to the Radius of the Circle, and here represented by the Semidiameter CZ, and CA, both these being the same, and thus divided, lay a Ruler from Degree to Degree in the Quadrants N and M, from A and B towards Z, *viz*. from 10° to 10°, 20° and 20°, 30° and 30°, &c. as you see actually in Figure 21, being all Parallels to ACB the Diameter, and numbred from C to Z accordingly: And that this is a true Line, representing all Sines of each particular Degree in the Quadrant, is visible in the Quadrant N, where the Natural Sines are let fall perpendicularly, from each 10 Degrees in the Quadrant, upon AC the Radius, which is equal and alike divided, as CZ; and this Line may be placed upon a Ruler, or otherwise, as may be seen below the Figure at cz.

Line of Tangents.

3. The Line of *Tangents* is represented by the Line BRTX, raised perpendicularly upon the End of the Diameter B, and it is divided into Degrees by laying a Ruler upon the Center C, through and upon every Degree of the Quadrant BC of the Circle, and to mark out the Divisions upon the Tangent-Line, as you see actually done for every 10 Degrees: And that this Tangent-Line thus divided, is the true Tangent-Line for this Circle, is plain by Proposition IX. of this Section; which may be transferred and placed upon a Ruler, as below is done upon bx.

Line of Natural Secants.

4. The Line of *Natural Secants* is represented by the Line B, r, t, and is described by fixing one Foot of the Compasses in the Center of the Circle C, and extending the other Foot to every Degree in the Tangent-Line, transfer the same into the Secant-Line B, r, t, as you see in the Figure, for every 10 Degrees, which is according to the Definition in Proposition X. and is described apart below in the Line bt.

Line of Half Tangents.

5. I will shew you another Division, very useful in many Propositions of the Sphere or Globe, especially for the Projecting thereof, which is, a Line of Half Tangents. This Line is made upon the Semidiameter or Radius CP, which is divided by laying a Ruler upon the Point A, and upon every Degree of the Quadrant V in the Circle PB, and marking the Divisions upon

upon the said Radius PC, as you see done, for every 10 Degrees: By which it is plain, that this Line is a Line of Half the Natural Tangents; for having continued the Tangent-Line downwards to 45 Degrees, every one of those will be two Degrees upon CP, because the Angles at the Center C are double to the Angles at the Circumference A, all represented below by *b r t*.

The Line of *Versed Sines* I meddle not with here, as having said already as much as is sufficient for this place, and shall leave the rest 'till another time.

Note, That 60 Degrees upon the Line of Chords, 90 Degrees upon the Sines, 45 upon the Tangents, and the first Beginning of the Line of Secants, are all equal to the Radius or Semidiameter.

XIII. Having described these Lines already, Geometrically and Naturally, and they being of such wonderful Use, that industrious Mathematicians have made Tables for every Degree, Minute, and Ten Seconds, in Numbers, I shall now proceed to give some light for the Making those Tables, and of their Nature, though the Demonstrations I must refer to another place.

After the Table of Logarithms, in the Third Part of this Work, follows the *Canon of Triangles*, which contains first the Tables of *Natural Sines*, *Tangents*, and *Secants*, and then the *Logarithms* of the Sines and Tangents. Of all these I shall give the following account.

Natural Right Sines in Numbers.

1. The *Right Sines*, in order to their Construction in Numbers, are either *Primary* or *Secondary:* The Primary are these, (by which the rest are found) first the Radius or Semidiameter, which is always put to be 1,000, 1,0000, 1,00000, or more, and is the Side of a sexangle Figure inscribed in a Circle, equal always to the Chord of 60 Degrees, as has been often remembred, is the first Primary Sine; from which it follows, that the half of the Radius, or the Chord of 60 Degrees, is the Sine of 30 Degrees, which Number if you seek in the Tables under 30 *Deg.* you will find against it the Sine ,50000. The other Primary Sines, are 60, 18, and 12 Degrees, being the Halves of the Chords 120, 36, and 24 Degrees, and may easily be found. Now the Secondary Sines of 6, 3, 1, *&c.* Degrees, are found from the former, and so the whole Table may be made by such Rules, that will be too long and intricate for you to know at this time.

Description of the Tables of Natural Sines.

The Table of *Natural Sines* begins with the Sine of 1 Minute, which is found to be ,00029, such as the Radius is 1,00000, and so proceeds to 60 Minutes, or 1 Degree, and so on in the first Column, from Degrees to Degrees and Minutes, 'till it comes to 45 Degrees, the Sine whereof is ,70711; and then returns from 45 Degrees to 1 Degree or 60 Minutes, and so back again in the second Column to 90 Degrees, which are the Complements of the first Column, or Remainder to 90 Degrees; as in these Examples.

Deg.

Deg.	*Min.*	*Sines.*	*Co-sines.*	*Deg.*	*Min.*
3	45	,06540	,99786	86	15
7	10	,12476	,99219	82	50
27	19	,45891	,88848	62	41
38	30	,62251	,78261	51	30
47	15	,73432	,67880	42	45
59	39	,86295	,50528	30	21
78	40	,98030	,19652	11	20

The first Column contains the Degrees and Minutes, proposed to find the Sines, which are set down in the second Column, and in the third Column is the Complements of those Sines, called for shortness *Co-sines*, and in the last Column are the Degrees and Minutes of the Quadrant, which are the Complements to those in the first Column to a Quadrant.

Thus may any Sine, for any Number of Degrees and Minutes to a Quadrant, be found quickly out.

Of Natural Chords.

2. The *Natural Numbers* for the *Chords* are easily deduced from those of the Sines, for because, as I shewed you before, the Sine of any Degrees is half the Chord of that doubled Arch; as the Sine of 30 Degrees being ,50000, doubled makes 1,00000, for the Chord of 60 Degrees, equal to the Radius: So if I desire the Chord of 38 Degrees, I seek in the Table for the Sine of 19 Degrees, the half thereof, which I find to be ,32557, which I double, and it makes ,65114, the Chord of 38 Degrees. And after this manner, I made the Table for the Chords, for each Degree to 90, for the Radius 1,000, of three Places only.

A Table of Chords for whole Degrees to 90°.

D.	Chord.	D.	Chord.	D.	Chord.	D.	Chord.	D.	Chord.	D.	Chord.
1	,017	16	,278	31	,534	46	,781	61	1,015	76	1,231
2	,035	17	,296	32	,551	47	,797	62	1,030	77	1,245
3	,052	18	,313	33	,568	48	,813	63	1,045	78	1,259
4	,070	19	,330	34	,585	49	,830	64	1,060	79	1,273
5	,087	20	,347	35	,601	50	,845	65	1,074	80	1,286
6	,105	21	,364	36	,618	51	,861	66	1,089	81	1,299
7	,122	22	,382	37	,635	52	,876	67	1,104	82	1,312
8	,139	23	,398	38	,651	53	,892	68	1,118	83	1,325
9	,157	24	,416	39	,668	54	,908	69	1,132	84	1,338
10	,175	25	,432	40	,684	55	,923	70	1,147	85	1,351
11	,192	26	,450	41	,700	56	,939	71	1,161	86	1,364
12	,209	27	,466	42	,717	57	,954	72	1,176	87	1,377
13	,226	28	,484	43	,733	58	,970	73	1,190	88	1,389
14	,244	29	,501	44	,749	59	,984	74	1,204	89	1,402
15	,261	30	,518	45	,765	60	1,000	75	1,217	90	1,414

This

This Table of Chords will be of good use, for the Making of Lines of Chords for any given Radius, as I shall forthwith shew you.

Natural Tangents and Secants.

3. The *Natural Tangents* and *Secants*, as they are expressed in the said Tables, and go along, (*viz.* the Tangents in the fourth and fifth Columns, those in the fourth for all Degrees and Minutes under 45°, and in the fifth for Tangents above 45°, and so for the Secants in the sixth and seventh Columns,) may be made out of the Tables of Sines, by several Proportions, too difficult and tedious to be here set down.

The Usefulness of these Tables will fully appear, when I come to the Resolution of Triangles. But before I go further, I will here shew, how the Scales (for any Radius) of Chords, Sines, and Tangents, may be easily made by them.

Fig. 21, 22.

First for Chords, if you make a Decimal Diagonal Scale of the Length of the Radius, (as for Example, to the Radius of the Circle in Figure 21 is made a Diagonal Scale in Figure 22,) and then with your Compasses if you take from that Scale the Numbers answering the Degrees in the Table of Chords last set down, and prick them down on a Line, you may make a Scale that will be just equal to the Scale of Chords, *p b* for 90°, or *p q* for 60°, described under Figure 21. For Example, if out of the Diagonal Scale you take ,551, the Number answering 32 Degrees in the Table, that Distance will reach from *p* in either of those Scales to 32°.

Uses of the Chords.

The Uses of these Lines of Chords are very great, for whereas I taught you (in the *Practical Geometry*) to measure or lay down Angles by the Circle divided, now by a Line of Chords you may do the same as suddenly, for if you take the Chord of 60 Degrees, and describe a Circle upon the Point of the Angle, the Scale will measure the Chords as in a Circle; and having three of them made of several Radiusses, they will be more proper than Circles of those Semidiameters.

Scale of Chords.

Scale of Tangents.

So likewise the Scales of *Sines*, *Tangents*, and *Secants*, described by *c z* for Sines, *b x* for Tangents, and *b r t* for Secants, may be made by the Tables, as well as before I shewed by the Circle it self. For Example, if I would find the Length of 41° of the Tangents, I look in the Table of Tangents and find ,869|29, and cutting off two Places to the right hand, as too exact for the business, I take ,869 from the Diagonal Scale in Figure 22, and setting one Foot of the Compasses in *b* on the Tangent Scale, the other will reach to 41° exactly.

XIIII. These Tables thus described, the Radius to them being 100000, and this Radius being always one Side of a Right-angled Triangle, the other two are expressed in the Canon or Tables by *Sines*, *Tangents*, or *Secants*.

Fig. 20.

For Example, let the Right-angled Plain Triangle B A C in Figure 20 be considered; if you make B C the Hypothenuse Radius, that is 1,00000, and if the Angle at B be 30 Degrees, equal to the Arch *a* C 30 Degrees, then is the Side C A the Right Sine of 30 Degrees, that is ,50000, and B A the Sine Complement of B (*viz.* the Sine of the Arch E C, equal to the Angle B C A) that is ,86603.

Again,

Fig. 20.

Again, if you consider the Right-angled Plain Triangle B *a c*, and make B *a* Radius equal to 1,00000, then will *a c* be the Tangent of 30 Degrees ,57735, and B *c* will be the Secant of 30 Degrees 1,15470. And this may be done for as many Triangles, as there are Lines for Degrees and Minutes in the said Tables; so that if you would know the Quantities of the Sides, and have but the Angles, you may set them down as before very easily.

Artificial Sines and Tangents.

Near to these Natural Sines and Tangents stand the *Artificial Sines* and *Tangents*, against their respective Degrees and Minutes, and are to be found as was shewed before in the Natural. The *Artificial Secants* are not set down, because they may be omitted, and the Resolution performed by the Sines and Tangents only. The Making of these Artificial Sines and Tangents I shall purposely omit, they being nothing but the Logarithms of the Natural Sines and Tangents, which Logarithms I shall shew the Reason of in the Last Part.

These things being premised, I shall now come to the Calculation it self of *Plain Triangles*, which (as much as I here intend) is nothing else, but to find out the Fourth Term from Three given, by the *Golden Rule of Proportion.* And these Four Terms are always Four Right Lines, whereof Two are always the Sides of one Right-lined Triangle, and the other Two are the Sides of another Right-lined Trangle, of Equal Angles with the former; so that all their Sides about their Equal Angles are Proportional, as it appears by Prop. XIX. Sect. I. of this Chapter.

All Right-lined Triangles are already Calculated in the Table of *Sines*, *Tangents*, and *Secants*, according to the Parts of the *Radius* of the Circle, into which the Triangle is adscribed, the said *Radius* being supposed to be 1 with Cyphers, as 1,0000 or 1,00000, &c. as before. If therefore you have a Triangle to be Resolved, you may do it by help of one of these Triangles, of Equal Angles with the Triangle to be Resolved; all the Parts of which Triangle are defined by the said Tables of Sines, Tangents, &c. and among the multitude of Plain Triangles defined by those Tables, you shall light upon the right one, by comparing the Parts of it with the Parts of the Triangle to be Resolved, as you may see in the following *Problems*, which I shew how to Resolve three manner of ways, *viz.* 1. By Scale and Compass: 2. By Natural Sines, Tangents, and Secants: And 3. By Logarithms.

SECTION

SECTION III.

The Calculation or Meaſuring of Plain Right-angled Triangles.

FOr the Calculation, there are two Problems, according to the twofold Variety in the Four Parts of the Triangle, which are Ingredients in the Queſtion, whereof the Right Angle (or 90 Degrees) is always one.

Problem I.

Of theſe Four, the Right Angle, One of the Acute Angles, the Hypothenuſe, and the Side ſubtending the Acute Angle; any Three being given, to find out the Fourth.

THe Right Angle being always 90 Degrees, equal to the Radius, is always given and known, wherefore any Two of the Ingredients will find the Third.

Fig. 23. Let the Triangle propoſed to be Reſolved be *a b c* in Figure 23, where the Angle at *b* is 23° 15′, therefore the Angle at *c* will be (its Complement to 90°) 66° 45′, the Hypothenuſe *b c* 347 Yards, and it is required to find out the Sides *b a* and *c a*.

1. To perform this by Scale and Compaſs, which you muſt have ready, and a Circle, or a Line of Chords divided exactly into Degrees, and let your Scale of Equal Parts be a Diagonal, ſuppoſe of Inches, as in Figure

Fig. 24. 24, with the Line of Chords adjoyning to it. Thus in Figure 25 draw a

Fig. 25. Line to repreſent the Baſe *b a* at length, ſet it off by the Line of Chords, taking 60 of it for the Radius, deſcribe the Arch *f d*, take out 23° 15′ from the Line of Chords, and ſet it from *d* to *f*, and draw the Line *b f c* at length, from the Diagonal Scale Figure 24, take off 347, (by ſetting the Compaſſes in the Line of 3 Inches for 300, then tell 7 of the Parallel Lines in the ſaid Line, and go up that Parallel Line 'till you meet with the Diagonal 4 that croſſeth it, that Diſtance is 347) which ſet from *b* to *c*, then from *c* let fall a Perpendicular *c a* upon the Baſe Line *b a*, and where it meets, as at *a*, the two Sides *b a* and *c a* are given and terminated, and taking them one after another, and applying them to the Scale Figure 24, you ſhall find *b a* 318.8, and *c a* 136.9 Yards, which is 318 Yards, and $\frac{8}{10}$ of a Yard, and 136 $\frac{9}{10}$ Yards. The ſame would follow, if you ſet off the Angle *c*, and let fall the Perpendicular *b a*.

But ſuppoſe the Baſe *b a* was given 318.8, and the Angle as before, to find out the Hypothenuſe and Cathetus *c a*, I draw a Line for the Baſe *b a*, and ſet off from the former Scale 318.8 from *a* to *b*, then upon *b* I ſet off 23° 15′, and draw *b c* at length, laſtly upon *a* I raiſe the Perpendicular *a c*, and

and ſo find by Meaſure *b c* 347, and *c a* 136.9. Thus is this Problem eaſily reſolved mechanically.

2. By *Natural Sines* the Proportion will be found thus: *As* Radius, or Sine of 90°, (the firſt Term,) *to* the Sine of the Acute Angle; (the ſecond Term;) *ſo* is the Hypothenuſe, (the third Term,) *to* the Side ſubtending the Acute Angle, (the fourth Term.)

The four Terms may be altered to find any of the things ſought; for the Rule being, 1 . 2 :: 3 . 4

By multiplying the ſecond and third Terms, and dividing the Product by the firſt, you will find out the fourth Term.

But if the third Term was ſought, then ſay,

2 . 1 :: 4 . 3

And if the ſecond Term was ſought, then ſay,

3 . 4 :: 1 . 2

And ſo of any ſuch Terms, which muſt be diligently obſerved.

Now the former Proportion is found out, as in Figure 25, where the Triangle propoſed to be Reſolved is *a b c* as before, and the Circle has in it *Fig.* 25. the Triangle A B C, Equi-angled to *a b c*, and therefore their Sides about B and *b* are proportional, that is, *As* B C Radius, *to* C A the Sine of C or *c*; *ſo* is *b c* the Hypothenuſe, *to* the Side *b a*. Becauſe they are both Right-angled, and the Angle B being made equal to the Angle *b*, the Angle C is equal to the Angle *c*. And ſo the Rule holds as above.

Therefore if the Side *c a* was demanded, it will be, *As* Radius 1,00000, *to* the Sine of the Angle *b* ,39474; *ſo* is the Hypothenuſe *b c* 347, *to* the Side *c a*. Multiply ,39474 by 347, and it gives 136.97478, which divided by 1,00000, gives for Anſwer 136.9, for the Side *c a*.

3. By *Logarithms*, which performs all without any labour of Multiplication and Diviſion; in ſtead of multiplying the ſecond and third Terms, add their Logarithms, and in ſtead of dividing by the firſt, ſubtract its Logarithm from the Sum of the other two, and the remaining Logarithm will give the Anſwer. But now you muſt call to mind the former Rules in *Arithmetick*, concerning Decimals and Logarithms.

The General Rule for Reſolving the laſt Problem, made by comparing the two Triangles, gives the following Analogies, wherein for the Hypothenuſe I take *b c*, for the Baſe *b a*, and the Cathetus *c a*, the Angles, *ſi.* for Sine, *ſi-co.* for Sine Complement, *t.* for Tangent, and *t-co.* for Tangent Complement; the Secants are ſet by.

To find c a, *by* b c *and the Angle at* b.

1. For *c a*	As *Radius*,	10,000000
	to *b c* 347;	2,540329
	So *ſi. b* 23° 15′,	9,596315
	to *c a* 136.98.	.12,136644

So the Cathetus *c a* is 136 $\frac{3}{4}$ Yards.

 2. For

2. For *b a*

As *Radius*,	10,000000
to *b c* 347;	2,540329
So *si. of c* 66° 45',	9,963217
to *b a* 318.82	2,503546

So the Base *b a* is 318 $\frac{3}{4}$ Yards.

Having the Base, or Cathetus, and one of the Angles, b *or* c, *to find the Hypothenuse.*

3. For *b c*

As *si. c.* 66° 45',	9,963217
to *Radius*;	10,000000
So *b a* 318.8,	2,503545
to *b c* 347.	2,540328

So the Hypothenuse is 347 Yards.

Again, *b c*

As *si. b* 23° 15',	9,596315
to *Radius*;	10,000000
So *c a* 136.98,	2,136644
to *b c* 347 *Yards.*	2,540329

So is the Hypothenuse 347 Yards, as before.

Having the Hypothenuse and Cathetus, or Base, to find the Angles.

4. Angle at *c*

As *Hypothenuse b c* 347,	2,540328
to *Radius*;	10,000000
So *Base b c* 318.8,	2,503545
to *si. Angle c* 66° 45'.	9,963217

So is the Angle at *c* found to be 66° 45'.

5. Angle at *b*

As *b c* 347,	2,540328
to *Radius*;	10,000000
So *c a* 136.9,	2,136644
to *Angle at b* 23° 15'.	9,596316

So the Angle at *b* is found to be 23° 15'.

Problem

Problem II.

Of these Four, the Right Angle, the Acute Angle at the Base, the Base, and the Cathetus; any Three being given; to find out the Fourth.

THE Operation in the last Problem, by the Compass and a Circle divided, will shew this or any other Proposition in Right-angled Plain Triangles; for suppose either of the Acute Angles, and either Base or Cathetus, be given, work thus: Upon Paper draw a Line that shall represent the Base B A, Figure 26, raise a Perpendicular at A, *viz.* A C, then for either the Base or Cathetus being given, set the same off from your Scale from A to B or C, then at B or C set off the Angle given, it will limit the Triangle, and give you the Hypothenuse, or the other Side. *By Scale and Compass.* *Fig. 26.*

I shewed you the Practice by the last Problem, and when you will exercise your Pen to Arithmetick, you may work this by Natural Sines and Tangents, multiplying in stead of adding, and dividing in stead of subtracting, as followeth by Logarithms. *By Natural Sines and Tangents.*

First for the Analogy, *As* Radius, (1,) *to* the Tangent of the Acute Angle at the Base; (2;) *so* is the Base, (3,) *to* the Cathetus, (4.) And if it be 1 . 2 :: 3 . 4 *By Logarithms.*

It will follow 2 . 1 :: 4 . 3

And 3 . 4 :: 1 . 2

This ariseth from comparing the Triangle B A C (Figure 26) with the Triangle B K D, (Figure 25,) alike and Equi-angled, because the Angle B, in the Triangle B A C, to be resolved, is equal to the Angle K B D, in the Triangle to be compared, and having either of them, the remaining Angles will be equal; and therefore, *As* B D Radius, *to* D K the Tangent of the Angle at the Base B; *so* is the Base B A given, *to* the Cathetus C A; which is the former Analogy, and to be varied as before, therefore, &c. *Fig. 25, 26.*

For C A

As *Radius*,	10,000000
to *Tangent of B* 23° 15';	9,633098
So *B A* 318.82,	2,503545
to *C A* 136.98	12,136643

For B A

As *Radius*,	10,000000
to *t. of C.* 66° 45';	10,366901
So *is C A* 136.98,	2,136657
to *B A* 318.82	2,503558

For

For the Angle at B	As *BA* 318.82,	2,503545
	to *Radius*;	10,000000
	So *is CA* 136.98,	2,136657
	to *t. Angle B* 23° 15′	9,633112

For the Angle at C	As *CA* 136.98,	2,136657
	to *BA* 318.82;	2,503545
	So *is Radius*,	10,000000
	to *t. Angle C* 66° 45′.	10,366888

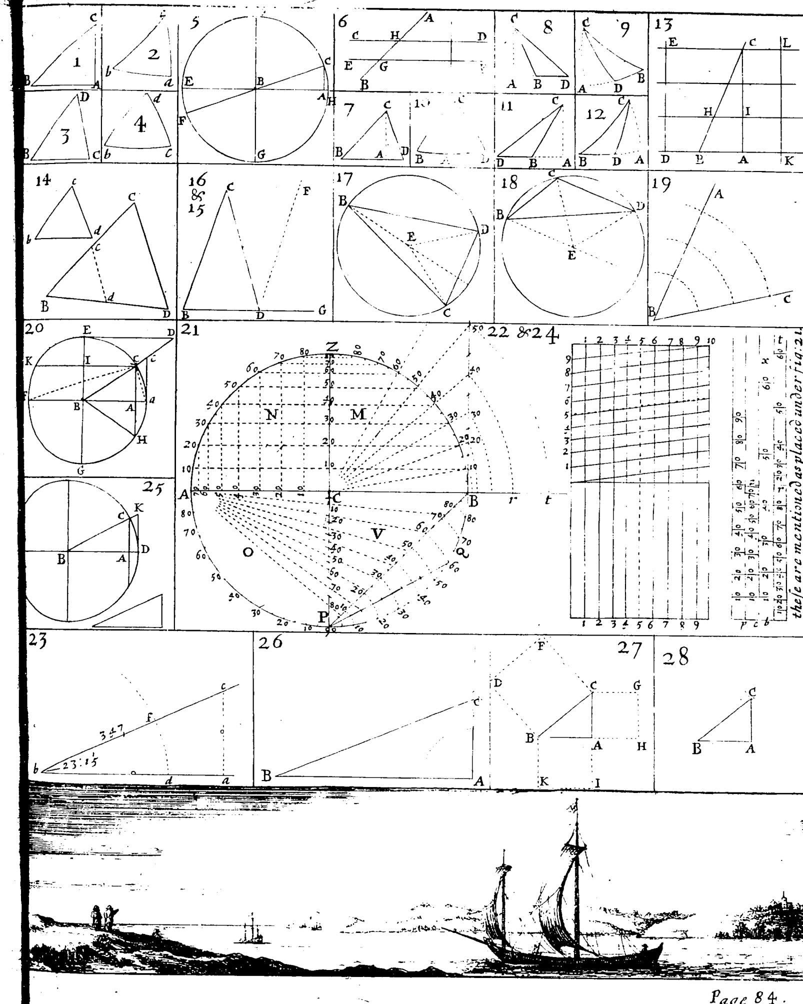
47 Pr. 1 Eucl. Here I think fit to declare the 47*th* Proposition of the First of *Euclid*, that is, That the Square of the Hypothenuse of a Right-angled Triangle, is equal to both the Squares made upon the Base and Cathetus; for Example see Figure 27, where ABC is a Right-angled Triangle, the Right Angle is A, the Square of the Hypothenuse is BCDF, which is always equal to the two Squares BAKI and ACGH; for 5, 4, 3, will be the Sides of such a Triangle, 5 for BC, 4 for BA, and 3 for AC, the Square of 5 is 25, the Square of 4 is 16, and of 3 is 9; now the Square of BC is 25, and the Squares of BA and CA are 16 and 9, which are equal to 25. *Fig. 27.*

By this Proposition, if any two Sides of a Plain Right-angled Triangle be given, the third Side is easily found; for suppose BA, 4; and CA, 3; to find BC, square 4 and 3, and they make 16 and 9, which added together make 25, the Square Root whereof is 5 for the Hypothenuse or BC.

Again, if the Hypothenuse BC, 5, and BA, 4, were given, to find the Cathetus; square them, and they make 25 and 16, take 16 out of 25, and there remains 9, the Square Root whereof is 3 for the Cathetus.

To raise a Perpendicular upon Paper. Here note, By these three Numbers, 5, 4, 3, you may either upon Paper, or upon the Ground, raise a Perpendicular most easily, even upon the End of a Line; for if it were demanded to raise a Perpendicular upon the Point A in Figure 28, from the Scale equally divided take 4, and set it from A to B, then take 3 in your Compasses, and make an Arch above A at C, as you see in the Figure, then from your Scale take 5, and setting one Foot of your Compasses in B cross the former Arch at C, then draw CA, so shall BCA be a Right Angle. *Fig. 28.*

Upon the Ground. But if the Right Angle were to be laid down on the Ground, take out the straight Line, then take a long Chord or Chain, and dividing it into Yards, Feet, or Fathoms, (a Fathom being 6 Feet) at every Yard or Fathom make a Knot, then upon the Line whereon it is required to raise a Perpendicular, fix the End of the Chord or Chain, and first mark out 4 Knots in the Line, after which taking an Iron Pin or Picket fasten it in the third Knot, and make a Score with your Pin over the Point, then shift your Pin into the fifth Knot, and fastening the End where you marked 4, cross that Arch, and from that place a Perpendicular, which will fall upon the Point given. Pro-



Page 84.

Problem III.

In all Plain Triangles, whether Right or Oblique-angled, of these Four Parts, Two Angles, and Two Sides subtending those Angles; any Three being given, to find out the Fourth.

THe Analogy for resolving this Problem will be this, *As* the Sine of one Angle, *to* the Side that subtends it, or is opposite; *so* the Sine of another Angle, *to* the Side that subtends it.

In Right-angled Triangles this Proportion is the very same with the first Problem, because the Radius is the Sine of the Right Angle, which is always subtended by the Hypothenuse. Yet in General, for all Plain Triangles, it is grounded upon the Proportion, that is between the Sides of a Triangle inscribed in a Circle, and the Triangle proposed to be resolved, being of Equal Angles with the Inscribed Triangle. Thus, let the Triangle proposed to be Resolved be BCD, and the Triangle inscribed be *b c d* Equi-angled to the former, wherein every Side is half the Sine of the opposite Angle, as shall be demonstrated; and seeing that the Halves of Proportional Numbers, bear the same Analogy that their Wholes do, it will be plain, *b c* is proportional to BC, *cd* to CD, and *bd* to BD; or, *As* the Sine of *b*, *to* BC; *so* the Sine of *b*, to CD; and the Sine of *c*, *to* BD; or, because the Triangles are Equi-angled, the Sine D is to BC, as the Sine B to CD, and as the Sine of C to BD. *Fig. 29.*

Example.

Let there be given the Angle at D 22° 30′, the Angle at B 52° 30′, the Side BC 346 Yards, and let the Sides BD and CD be sought.

1. By Scale and Compass: Draw a Line EF, whereon by your Compasses and Scale set off 346 from B to C. Then set off 105°, which is thus gotten, sum up the Angles B and D, which make 75°, take that from 180° (the Sum of all the Angles) and there remains 105 for C. Then taking 60 upon your Circle, or Line of Chords, for the Radius, describe two Arches upon the Points B and C at *x* and *y*, and at B set off 52° 30′ from *y* to *r*, and at C from *x* to *s*, and draw the Sides BD and DC; then have you the Point D for the Triangle. And upon the same Scale, if you measure CD, you will find it 717.3 Yards; and BD, 873.3 Yards. *By Scale and Compass. Fig. 29.*

2. By Natural Sines, the Proportion, as before is declared, will stand thus: *As* the Sine of D 22° 30′, ,38268, *to* the Side BC 346; *so* the Sine of B 52° 30′, ,79335, *to* the Side CD, which is 717.3, as by working this Question will appear. First, I multiply the Third Term ,79335 by 346 the Second, which makes for the Product 274.49910; and then I divide that by ,38268, which gives the Quotient 717.3, that is 717 $\frac{1}{4}$ Yards for the Side CD. *By Natural Sines.*

,38263

```
,38268 . 346 :: ,79335 . 717.3
                  346
                 476010
                317340
               238005
,38268 ) 274.49910 ( 717.3
         267876
          66231
          38268
          279630
          267876
           117540
           114804
             2736
```

The next Operation by the Logarithms will shew you, what ease in Calculation comes by that Noble Invention.

By Logarithms. 3. By the Logarithms, thus: Set the Logarithms of the first, second, and third Terms down, as in the following Work, then add the second and third Terms together, which make 12,438542, out of that take the first Logarithm 9,582839, and there remains 2,855703, the Logarithm of 717 ¼ Yards.

Sine of D 22° 30′, its Logarithm	9,582839
The Side BC 346, its Logarithm	2,539076
Sine of B 52° 30′, its Logarithm	9,899466
Sum of the second and third	12,438542
First out of the fourth	2,855703

Now it was shewed, that all Angles of a Plain Triangle are equal to two Right Angles, therefore having the Sum of the Angles B and D 75 Degrees, take that from 180, and it leaves 105 Degrees; but you must use 75 to find out the Sine amongst the Table of Sines, because the Right Sine of 75 Degrees, is the Sine of 105 Degrees, as you have been taught already; and you may see it by the following Work, in seeking out the Side BD, which is found to be 873.33 Yards. Then have you all the Sides and Angles of the Triangle BCD. And so having the Angles, there is no difficulty to get the Sides.

Sine

Sine of D 22° 30′, its Logarithm	9,582839
The Side BC 346, its Logarithm	2,539076
Sine 105°, or 75°, its Logarithm	9,984944
The second and third Terms added	12,524020
The Logarithm of 873.33	2,941181

But if one Angle only be given, and two Sides, whereof one is the greatest Side in the Triangle, and the other opposite to the Angle given, and the Angles be required, then it will be a doubt, whether that Angle be Acute or Obtuse which is opposite to the greatest Side, it is requisite therefore it be declared, by laying down the same by Scale and Compass.

Example.

Having the Side BC 346 Yards, BD 873.33 Yards, and the Angle at D 22 Degrees 30 Minutes; to find the Angle at C.

Lay down the Side BD 873.33 from B to D, on D raise an Arch equal to the Angle 22° 30′, draw out BC at length, take BC 346, and cross that Line at C, draw the Triangle BCD, and measuring the Angle at C you will find it 105° Obtuse, whose Complement to 180° being 75° is to be used in its stead. *By Scale and Compass.*

The Work by the Logarithms finds the Angle 75°, whose Complement to 180° is 105°, for the Angle C. *By Logarithms.*

As the Logarithm of 346,	2,539076
to the Sine of the Angle D 22° 30′;	9,582839
So the Side 873.33,	2,941181
	12,524019
to the Sine of the Angle C 75°.	9,984943

Whose Complement 105° is the Angle C.

Problem IV.

In all Plain Triangles, whether Right or Oblique-angled, Two Sides being given, with the Angle between them; to find out the other Two Angles.

THis is done by the following Analogy, demonstrated in the Last Part, *As* the Sum of the two Sides given, *to* the Difference of those two Sides; *so is the* Tangent of Half the Sum of the opposite Angles, *to* the Tangent of Half the Difference of these Angles.

And

And if you add together the Half-sum and half the Difference of the Angles, it makes the greater Angles, and subtract them, it makes the less.

Example.

Let there be given the Side CD 717.3, the Side BC 347, and the Angle C 105°; to find out the Angles B and D.

By Scale and Compass. 1. By Scale and Compass, lay down upon Paper the Angle BCD 105°, and take with your Compasses the Distances 717.3 and 347, and set them off from the Point C on either Leg to B and D, draw BD, and measuring the Angles, you will find B 52° ½, and D 22° ½.

By Logarithms. 2. By the Logarithms, the Work will stand thus:

Sum of the two Sides 1064.3, its Log.	3,027064
Difference of the Sides 370.3, its Log.	2568554
Half the Sum of the Angles 37° 30′, t.	9,884980
	12,453534
Tangent of Half the Difference 15° is	9,426470

Now, to explain this Example, the Angle given is 105° an Obtuse Angle, I subtract this from 180°, equal to two Right Angles, and it gives me 75° for the Sum of the Angles B and D, the Half-sum is 37° 30′, and the Half-difference is found as above 15°, I add that to the Half-sum, and it makes 52° 30′ for the Angle B, and then subtracting 15°, the Half-sum, from 37° 30′, the Half-difference, it leaves 22° 30′ for the Angle D.

Problem V.

In all Plain Triangles, whether Right or Oblique-angled, all the Three Sides being given; to find out the Cases made by the Perpendicular, falling upon any Side put for the Base, (extended if need be) and consequently all the Angles, and the Perpendicular it self.

By Scale and Compass. TAke any Side, which you please, suppose BD 873.3 Yards, and lay it down with your Compasses upon the Line drawn at length, taken from your Scale, then take from that Scale BC 346, and make an Arch about C; lastly take CD 717.3, and setting one Foot of your Compasses in D, cross that Arch at C, and draw CB and CD, and measuring them, you shall find C 105°, B 52° ½, and D 22° ½, in all 180°. And that you may not be deceived by an impossible Question, you must be sure, that any two Sides of your Triangle be longer than the third. *Fig. 30.*

But to Calculate this Problem, the Resolution whereof depends upon the the 36 *Prop.* 3 *Euclid*, it is demonstrated in Figure 30, where the Rectangle made of DB into D*b*, is equal to the Rectangle of DH into DG, that is,

DB . DH :: DG . D*b*

This premised (in that Figure) it is plain, by letting fall the Perpendicular CA, that D*b* is the Difference of the Cases of the Base DA and AD, and DG is the Difference of the Sides DC and CB, equal to CH; therefore the former Proportion will stand, *viz.*

As the Base, or the two Cases of the Base,	BD,
To the Sum of the Legs:	DH = DC + CB
So is the Difference of the Legs,	GD
To the Difference of the Cases.	*b*D

Example.

In the Triangle BCD (Figure 30) let the Sides be thus, BC 346 Yards, DC 717.3 Yards, BD 873.3 Yards; and let the Cases of the Base BA and AD be enquired. *Fig. 30.*

First make the Terms fit for the Analogy, thus:

The Side DC	717.3
The Side BC	346
Their Sum	1063.3
Their Difference	371.3

Then,

As the Side BD 873.3,	2,941663
to the Sum of the Sides 1063.3;	3,026655
So is the Difference 371.3,	2,569724
	5,596379
to the Diff. of the Cases 451.56 *b*D.	2,654716

By Logarithms.

And BD 873.3, made less by *b*D 451.56, gives 421.74 for B*b*, which divided by 2 gives 210.87 for BA, and added to *b*D gives 662.43: Then in the two Right-angled Triangles BCA and CAD, you have the Bases and Perpendiculars to find the Angles, and by consequence all the Angles of the Triangle BCD, with the Perpendicular CA.

The Analysis of Plain Right-angled Triangles.

Problem I. & II.

By the Hypothenuse and Angle, to find the Side.

R . S,B : BC . CA
R . S,C : BC . BA

N By

By the Hypothenuse and Side, to find an Angle.

BC . CA :: R . s,B
BC . BA :: R . s,C

By the Angle and Side, to find the Hypothenuse.

s,B . R :: CA . BC
s,C . R :: BA . BC

Problem III.

By two Angles, and a Side opposite to the one, to seek the Side opposite to the other.

s,D . BC :: s,B . CD

By two Sides, and an Angle opposite to one, to find the Angle opposite to the other.

BC . s,D :: CD . s,B

Problem IV.

By two Sides, with the Angle between them, to find the other two Angles.

As the Sum of the Sides,
To their Difference :
So the Tangent of Half the Sum of the opposite Angles,
To the Tangent of Half the Difference.

Half the Sum added to Half the Difference is the greater Angle, and Half the Sum less by Half the Difference is the lesser.

Problem V.

By three Sides, to find the Angles.

As the Base,
To the Sum of the Legs :
So the Difference of the Legs,
To the Difference of the Cases of the Base.

The Base less by the Difference of the Cases divided by 2 is the lesser Segment, which added to the said Difference gives the greater.

SECTION

SECTION IV.

The Measuring of Distances inaccessible, of Heights, Depths, &c.

I. FOr the Instruments for Taking of Angles for Distances, Heights, &c. there have been almost infinite sorts invented and proposed, but because they are all deduced from that of a Circle (which has been sufficiently explained already) I shall mention only those of a *Circle*, a *Semicircle*, and a *Quadrant*.

1. The *Circle* (as in Figure 1) being divided into 360 Degrees, and every Degree divided into Parts, according to the bigness of your Instrument; as little ones into Half-degrees, or 30 Minutes; greater into Quarters or 15 Minutes, or into six Parts or 10 Minutes. I say, this Circle being divided into four Quadrants, each Quadrant containing 90 Degrees, or into two Semicircles, each Semicircle containing 180 Degrees, and planted on a Three-legg'd Staff, it will take the Angles at Land: Or if it be hung on your Finger by a small Ring, as *a*, by the Index *b c d*, on which are placed two *Dioptra's*, or little Holes, either to look or let the Sun shine through, you may take the Angles of Heights and Depths, and the Height of the Sun and Stars. *Fig.* 1.

Note, That in the last Position, care must be taken, that the Line *a f* be Perpendicular, which may be tried by a small Hair and Plummet before it be used.

Note also, That for taking Angles at Land, a Semicircle according to Figure 2 will be more commodious than the whole Circle. *Fig.* 2.

2. The *Quadrant*, or Quarter of a Circle, divided into 90 Degrees, and those subdivided as before into Parts, is the only Instrument for Heights and Depths, as Figure 3 makes plain. It is either to be fixed upon a Staff, and then it is called the *Fixed Quadrant*; or else it is to be held moveable in the Hand, and to play with a moving Thread and Plummet, and it is then named the *Moveable Quadrant*. *Fig.* 3.

Note, That when you make use of the Fixt Quadrant, the Side A B must be truly Perpendicular, which may be tried by a Hair and Plummet, for a little deviation will cause a great Error.

Note likewise, That the Moveable Quadrant with a Pendant never needs to be regarded, in respect of the last Note; but there are two things which must be observed, lest Errors be committed; one is, that the Hair (or Silk) and Plummet may play free from touching or hanging upon the Face of the Quadrant, whilst you are trying to take the Height desired; the other, that the Line and Plummet rest quietly, to which end you may easily stay the vibrations from playing too far, and if at last some motion remain, the middle way betwixt the Extreams may be taken.

II. The Explication of some Terms and Definitions will be needful here, *viz.*

1. The *Height*, is the Perpendicular from the Top of any Place to the Superficies of the Earth, and directs to the Center of the Earth, as C A in the Figures 4, 5, 6, 7, 8, and 9

Fig. 4, 5, *&c.*

2. The *Distance* of the Eye to the Bottom of the Height, is always Perpendicular to the Height, as B A in all the before-mentioned Figures. And other Distances, from the Eye to any part of that Perpendicular, are not so.

3. The *Angle* of the *Height*, is A B C, which the Line of Distance makes with the Line of Height.

4. The *Angle* of the *Interval* of two Places, , is the Angle made by the Lines directed from the Eye to those Places.

5. An *Accessible Height*, is that which may be Mechanically Measured.

6. An *Inaccessible Height* or *Distance*, is that which cannot be Measured, by reason of some Impediment in the way, as Water, *&c.*

III. I shall now lay down the manner of Taking an Angle of Altitude three several ways, *viz.*

1. By the *Astrolabe*, or Whole Circle, hanging perpendicularly either upon your Finger, or upon any other thing, as a Three-legg'd Staff, or upon the Pin of a Stick stuck fast into the Ground: Turn the Plain of the Circle towards the Altitude C A, Figure 4, and directing the Sights towards C, lift them up and down, 'till through the Sights (or by them) you see the Point C, which done, you have the Arch of the Angle between the Horizontal Line S L and the *Dioptra* or Sights. Consider the Work twice, for more certainty.

Fig. 4.

2. By the *Fixt Quadrant* upon a Staff, so set in the Ground, that F B by a Plummet may be perpendicular: Turn the Sights, as was before directed, and the Angle of Height will be L *o*.

Fig. 5.

3. By the *Moveable Quadrant*, or that which hath a Moveable Pendulum, being either placed on a Staff or held in your Hand: Move the Quadrant so, that by the Sights B *o* you may perceive the Point C, the Pendulum *o* F playing by, but clear from the Quadrant, 'till the Plummet rest, and then you have the Arch *z f* for the Angle desired.

Fig. 6.

Much after this manner, if you lift and fit the Quadrant so, that the Sun may shine through one Sight upon the Point of the other, and the Pendulum play easily upon the Side, the Thred or Hair will shew the Height of the Sun.

And the same, or the like Work, will take the Angle of the Distance, as is visible by the Angle B C A in the Figures 7, 8, and 9.

Fig. 7, 8, 9.

IV. To find the Angle of the Interval, or the Distance of two Places, either by the Circle, Semicircle, or Quadrant, is very apparent, whether the Angle be Acute or Obtuse; but to do it by the Quadrant alone, will need some Directions, which take in this Example. Suppose the Angle be Acute, as *adb* in Figure 10; plant the Side of your Quadrant *dt*, to the Mark *a*, so as the Limb may lye towards *b*, as *emt*, then looking at the Mark *b*, the Distance *tm* upon the Limb is the Angle. But if the Angle be Obtuse, as *adl*, then turn the other Side of the Quadrant *dt*, and the Limb from the Mark to *g*, and direct the Sights *dh* to C, then will *th* more 90 Degrees be the Angle desired.

Fig. 10.

Thus much premised, I come to the Problems themselves.

Problem I.

Of these Four, the Distance to a Building, the Height thereof, the Hypothenusal Line, and the Angle; any Two being given, to find the rest.

THese three are the Sides of a Right-angled Plain Triangle, as you may see in Figure 11, B A being the Distance, C A the Height, and B C the Hypothenusal Line: The Angles of which Triangle are easily found, for the Right Angle is at A, the Foot of the Building, and one of the Oblique Angles may be easily taken by a Quadrant, or the other Instruments lately described, the Observer standing either at B or C, which being known, the other Oblique Angle is the Complement thereof.

Fig. 11.

The Angles being known, and one of the Sides, the other Sides are easily found by the second and third *Problems* of Plain Triangles before taught, unto which I refer you, and you may find the same either by Scale and Compass or Calculation.

Problem II.

A Part of the Distance unto a Building, Hill, or other Height, being known; to find the other Part, the Height, and the Hypothenusal Line.

ONe Part of the Distance suppose *b* B, the other B A, and the Height C A, together with the Hypothenusal Lines, *b* C or B C, will easily be manifested in this manner.

Fig. 12.

With your Quadrant, take the Angles at the two Stations *b* and B, *viz.* C *b* A and C B A. Then,

First, to do it by Scale and Compass, lay down a Line at length *b* B A, set the Distance in Yards, Perches, *&c.* from *b* to B, then measure out the Angles C *b* A and C B A, and lay them down, and mark the Place where the Lines *b* C and B C cross, as at C, letting fall the Perpendicular C A upon *b* A; then if you measure the Lines, C A will be the Height, B A the Distance, and *b* C and B C the two Hypothenusal Lines.

Secondly, by Calculation, supposing C A to be the Radius, B A will be the Tangent of the Angle B C A, (which is the Complement of the Angle

Fig. 12. Angle C B A,) and *b* A will be the Tangent of the Angle *b* C A, (the Complement of the Angle C *b* A,) and *b* B will be the Difference of these Tangents. Take therefore these Tangents out of the Table of Natural Tangents, and find their Difference, by subtracting the lesser out of the greater; which being done, first for the Distance B A, say, *As* the Tangent of *b* C A less by the Tangent B C A, *to* the Tangent of B C A; *so* is *b* B, *to* B A.

Then, for the Height C A, say, *As* the Tangent of *b* C A less by the Tangent B C A, *to* the Radius; *so* is *b* B, to C A.

And lastly, for the Angles, subtract the Angle C B A out of 180°, and it gives the Angle *b* B C; subtract also the Angle C *b* B out of C B A, and it will give the Angle *b* C B; because the Outward Angle C B A, is equal to C *b* B and C B A, the two Inward and Opposite Angles.

And thus you have all the Angles of the Triangle *b* C B, and the Side *b* B, whereby either of the Hypothenusal Lines, *b* C or B C, may be found out by the third *Problem* of *Plain Triangles.*

Problem III.

To take the Height of any Thing above us, removed at a competent distance, as of a Cloud, or the like.

Fig. 13. 1. If two Stations can be had of the same side of the Thing above us, then the Height is found out the very same way, that the Height C A is found out in the last Problem. Suppose, in Figure 13, that the Thing above us were C, and the Angles were taken at the two Stations *b* and B, and the Distance of the Stations measured were the Space *b* B, then the Perpendicular Height C A will be found, as the Height C A in the Problem aforesaid.

2. But if one Station be on one side of the Thing whose Height is to be taken, and the other Station on the other side, as the Stations B and D, then the Tangents of the Angles B C A, and D C A, are to be added together, the Analogy for the Perpendicular Height being this, *As* the Sum of the Natural Tangents, B C A and D C A, *to* the Radius; *so* is B D, *to* C A.

3. But seeing that two such Observations, at several Stations, can scarcely be had for measuring the Height of a Cloud, although the diligence of two Observers were very great, it will not be amiss to shew, how one Observer may supply the place of two, and take the Angles of the Cloud's Altitude for two Stations at the same time, he standing but at one; which is done by this Artifice:

When the Sun shineth, let the Measurer make choice of a fit Cloud for his purpose, and let him mark the Place upon the Earth where the Shadow of the Cloud falleth; then being removed a convenient Distance from the Place of the Shadow, let him with a Quadrant take the Angle of the Height of the Cloud, and also of the Height of the Sun, which Angle of the Height of the Sun is the Angle of the Cloud's Height in the Place where the Shadow falleth; for if another Observer should stand at the Place of the Shadow, both the Cloud and the Sun to him would have the same Angle of Height. All which may be manifestly seen in Figure 13.

For let S be the Sun, C the Cloud, *b* the Shadow of the Cloud upon the Earth, and B the Station of the Observer, where if he take the Angle C B A, of the Clouds Height, for the Station B, and the Angle of the Sun's Height at the same time; he taketh also the Angle C *b* A of the Clouds Altitude at the Station *b*; the Angle S *b* A being equal to the Angle C *b* A, and *b*, C, and S, being in a Right Line.

Note, That by the Sun's Height, especially at 45 Degrees, when the Shadow is equal to the Height required, then may be taken the Height by that Shadow, by measuring it accordingly.

Problem IV.

A Part of the Height of any Building, or Upright Thing, being known, to find the other Part, and so the whole Height, together with the Distance and Hypothenusal Line.

If you invert Figure 12, belonging to the second Problem, so that *b* A be the Height of the Building, *b* B the Part of the Height known, and C A the Distance, then the Calculation will be the same with that of the said Problem. *Fig.* 12.

Problem V.

To find the Distance from the Observer unto a Mark Inaccessible.

Let the Place of the Observer be at B, and let the Distance betwixt B and the Mark C be required. First, from B side-wise chuse another Mark or Station at D, the further the better, and there set a Beacon. Then, *Fig.* 13
1. With your Quadrant, or Semicircle, take the Angle C B D.
2. Measure the Distance B D in Yards, Perches, &c.
3. Standing at D, take the Angle B D C.

By Scale and Compass, if you lay down the Line B D, and set off the Angles at B and D, it will find the Point C, and give the Distance B C on the same Scale.

4. Add together the Angles B and D, and subtract their Sum from 180°, and the Remainder will be the Angle at C. Say then, by the Analogy of the third Problem of Plain Triangles, *As* the Sine of C, *to* the Side B D; *so* is the Sine of D, *to* the Side B C.

Problem

Problem VI.

To find the Distances between any Two Places, both removed from the Observer.

Fig. 15. LEt the two Places be B and D, and let their Distance be required by an Observer standing at the Point C.

1. Let the Angle BCG be taken, between one of the Places, as B, and any visible Mark, suppose G or F, standing about the middle of the Distance; and likewise let the Angle GCD be taken, between the said Marks G or F, and the other of the Places, D.

2. Then leaving a visible Mark at C, let the Observer go backwards unto another Station, as at H, in such manner, as that he being at H, may see the Marks C and G, or F, in a Right Line; and let him measure the Distance between the two Stations C and H.

3. At H let him take the Angles BHG, and GHD, as he did before at C.

This being done, in the Triangle HBC, because the outward Angle BCG is equal to both the inward and opposite Angles BHC and HBC, therefore by subtracting BHC out of BCG, there will remain the Angle HBC. Thus all the Angles in the Triangle HBC, and the Side HC, being given, either of the other two Sides are easily found by the third Problem of *Plain Triangles.*

Again, in the Triangle HDC, the Angle HDC, and either of the Sides CD or HD, may be found in the same manner.

Lastly, in the Triangle BCD, the two Sides BC and DC being found, (as is already taught) and the Angle BCD, by Observation, the other two Angles CBD and CDB, may be found by the fourth Problem of *Plain Triangles*, and consequently the Side BD by the third Problem of *Plain Triangles*, which is the Distance required.

The same also may be had in like manner, by the Sides BH and DH, with the Angle BHD, in the Triangle BHD.

Another way of Resolving the Problem.

Fig. 16. In Figure 16, let B and D be the two Places, and let their Distance be required by an Observer standing at the Point C.

1. At C let the Angle BCD be taken between the two Places, and also the Angle DCG, between the Place D and a visible Mark F or G, on the side of the Observer, the Sum of which two Angles is the Angle BCG, which for more proof may likewise be taken by the Instrument.

2. Then let the Observer go towards the Mark F as to G in a Right Line, which is easily done at Sea by help of the Compass, and at Land, by looking from C, so that G be in a Right Line from it to F; let him measure also the Distance CG, which at Sea is done by help of the Log-line.

3. At

3. At G let the Observer take the Angle again between both Places, the Angle BGD, and also the Angle GDF, the Sum of which two Angles is the BGF, which may also be taken by the Instrument, for the better satisfaction of the Observer.

Then in the Triangle BCG, because the outward Angle BGF is equal to both the inward and opposite Angles BCG and CBG, therefore by subtracting DCG out of DGF, there will remain the CBG; by which Angle CBG, and the Side CG found by Measure, and the Angle BCG, the Side BG is found by the third Problem of *Plain Triangles.*

Again, in the Triangle CDG, because the outward Angle DGF is equal to both the inward and opposite Angles DCG and CDG, therefore by subtracting DCG from DGF, there will remain the Angle CDG, by which Angle CDG, and the Side CG, and the Angle CDG, the Side DG is found by the Problem aforesaid.

Lastly, in the Triangle BGD, the two Sides BG and DG, being found, as hath been tought, and the Angle BGD by Observation, the other two angles, GBC and BDG, may be found by the fourth Problem of *Plain Triangles*, and consequently the Side BD by the third Problem of *Plain Triangles*, which is the Distance required.

Note, in taking Distances, 1. That the two Stations be at as great Distances, as conveniently may be.

2. That the Side Station is much more convenient than directly in a Line.

Note, in measuring Altitudes, That you be not too near, nor yet too far off, but if it may be, chuse the Place where the Angle of the Altitude will be 45°, or near unto it, for thereabouts will be the most sensible alteration of the Angle at C.

Problem VII.

Of Levelling, or Measuring the Inequality of Places, as to their Heights.

TO find out the Difference of Heights of one Place from another, in the Rising and Falling, which is of constant use inconveying of Water, either above the Ground for Fountains, &c. or under the Ground for Adyts or Soughs, &c. let yout Instrument be carefully made, whether it be a Quadrant, Water-level, or any other; the best I account to be a Brass T, the Sights upon the Top of the T to be Perspective Glasses, which must be tried before used, and the Glasses are to stand always one way. This will endure longer Stations than ordinary, and is for many Reasons the best, if substantially made, and there must be two Mark-boards placed upon Quarter-Pikes, that your Assistants may lift them higher or lower, as they shall be directed.

Then set the Level as near as you can betwixt the two Marks wich your Assistants hold upright in their hands, with the slipping Marks; turning to

O one,

one, cause him to hold or set the Slit and black Stroke even with the Level-Sights, and so the other. The Difference of these Sights, in Inches and Tenth Parts, gives the Ascent or Descent, and this is for one simple Station; but if it require both Ascents and Descents, then in a Note-book set down your Back-stations in one Column, and your Fore-stations in another; sum up both the Columns, and take the Difference of them, if they be equal, the two Places are level, if your Fore-stations exceed, the Difference is lower, if otherwise higher, an example will clear all.

Fig. 17. I am to give the Difference of the Heights of the Places A and B, from the Line of Level S B, choosing my first Station at C, where I plant my Instrument, betwixt the Quarter Pikes A and F, and setting my Level firm, the Assistants lifting up and down the Mark-boards, 'till both ways the Sights take the black Strokes at D and E; in a little Table made set down the Heights of those Strokes from the Ground, in two Columns, one for the Left-hand Height, the other for the Right, as you see in the Table adjoyning, wherein A D (for the Left-hand) is found to be 4 Feet, 3 Inches, and $\frac{2}{10}$ of an Inch, and E F (for the Right-hand) 7 Feet, 1.5 Inches. Again, let the second Station be at G, and the Left-hand Height F H be 10 Feet, 3 Inches, and a Half, and the Right-hand Height I K 3 Feet, 3.7 Inches. Again, the third Station let be at M, and the Heights be I L 2 Feet, 9.4 Inches, and O N 12 Feet, 1.5 Inches. Lastly, let the fourth Station be at P, and the Heights O Q 3 Feet, 10.9 Incees, and B R 11 Feet, 9.8 Inches. The Sum of the Heights on the Left-hand is 21 Feet and 3 Inches, that of those on the Right 34 Feet and 4.5 Inches; their Difference is 13 Feet and 1.5 Inches, and so much is B lower than A.

Stations.	*Heights on the Left-hand.*		*Heights on the Right-hand.*	
	Feet.	*In.*	*Feet.*	*In.*
1	4	3.2	7	1.5
2	10	3.5	3	3.7
3	2	9.4	12	1.5
4	2	10.9	11	9.8
	21	3.0	34	4.5

Sum of the Heights on the Right-hand	34	4.5
Sum of the Heights on the Left-hand	21	3
Their Difference	13	1.5

Which is the Difference of the Height that B is lower than A.

Problem

Problem VIII.

Of Taking the Plot of a Country, City, Bay, or Harbour, or such like Place.

THis Proposition finds the Proportional Distances of divers Objects, (which one would represent and lay down) which is done by two or more Stations, at every one whereof are formed many Triangles, whereof a Side and two Angles are always given, which sufficeth to find out the Distances, both to and betwixt any Places proposed.

For Example, suppose it were required to represent in Proportion the Objects A, B, C, D, E, F, I, K, L. To do which, I take two Stations A and B, so that the Distance betwixt them may be actually measured by Feet, Fathoms, or Perches, upon the Ground, suppose 350 Perches, which set down in your Note, and so, that A and B be taken long enough to make a Common Base, fit for all the Triangles enquired after. First then, placing your Instrument (whether it be a Semicircle, Quadrant, or Circle) upon A, direct the Beginning of the Division upon the Line A B, where by the Skrew or other means fix the Instrument fast, that it may not turn; then begin and take the several Angles B A L, B A K, B A F, B A I, B A E, B A D, and B A C, which set down upon your Note one after another. Secondly, removing your Instrument to B, set the Beginning of the Degrees upon B, and take the Angles A B C, A B D, A B E, A B I, A B F, A B K, and A B L, which set down likewise upon your Note. Then having a clean Sheet of Paper, and having by you a convenient Scale, Line of Chords, Circle, or Protractor, draw a Line below upon the Sheet, as you see *a b*, and from the Scale take 350 Perches, and set it from *a* to find the Point *b*, so is *a b* the Stationary Line whereon the Angles are to be placed, thus, upon *a* from the Line *a b* set off the Angles *b a l*, *b a k*, *b a f*, *b a i*, *b a e*, *b a d*, and *b a c*, and upon *b* from the Line *b a* set off the Angles *a b c*, *a b d*, *a b e*, *a b i*, *a b t*, *a b k*, *a b l*: So upon the Paper, you have the true Proportional Places at *c*, *d*, *e*, *f*, *i*, *k*, *l*, answerable to the Places upon the Country, C, D, E, F, I, K, L; and by a Pair of Compasses, and the same Scale of Perches that you set off *a b* 350 Perches, you may measure the Distances from *a*, or *b*, to any of the aforesaid Places, and the Distances of one Place from another, as from *c* to *d*, from *t* to *l*, from *e* to *k*, &c. And if you were to describe more of a Country, beyond these Places, from any two Places, as from *c* and *g*, which you may make your Stationary Line; first from one, as at *c*, draw Lines to these new Places, and then intersect them again from *g*, and you may accomplish your desire. (Fig. 18. / Fig. 19.)

After this manner, you may describe the Plain of any City, or other Place whatsoever.

 CHAP.

CHAP. IV.

Of Spherical Trigonometry, or the Calculation of Spherical Triangles.

Section I.

YOu, that desire to be Calculators of *Spherical Triangles*, ought to have some competent Knowledge in the Circles of the Sphere or Globe, which will be sufficiently explained in the next Chapter, without which, it is impossible you should do much in this Doctrin, therefore in this place I will touch only such things, more nearly concerning *Trigonometry* it self in *Sphericals*: And then after the perusal of the next Chapter, you will perceive the Uses and Advantages of this Doctrin.

I. You were taught some Definitions, concerning both Plain and Spherical Triangles together, in the Eight first Propositions of the First Section of *Plain Triangles*; you must know further, That the Sides of *Spherical Triangles* are the Arches of a Great Circle of the Sphere or Globe, every one of those Sides being severally less than a Semicircle.

II. A Great Circle is that which divideth the Sphere or Globe into two Equal Parts, so that it is distant from its Poles every where by a Quadrant, or a Quarter of a Circle; such are the *Horizon*, the *Meridian*, the *Equinoctial*, the *Ecliptick*, *&c.* on the Globe.

III. You were taught before in *Plain Trigonometry*, That the Measure of a Plain Right-lined Angle, was so much, as the Degrees and Parts of a Circle described upon that Angular Point on a Plane, and intercepted betwixt the Sides of the Angle, would come to. But these Spherical Augles described naturally upon the Globe, and intercepted by two Parts of Great Circles, between the Sides of the Angle drawn forth unto Quadrants, are measured by an Arch of a Great Circle described upon the Angular Point on the Globe or Sphere.

IV. If

IV. If a Great Circle pass through the Poles of another Great Circle, it intersecteth it by Right Angles.

V. A Spherical Triangle, is either Quadrantal, or not Quadrantal.

VI. A Quadrantal is that which hath one Side, or Angle, at the least equal to a Quadrant, and is either Manifold, or Single.

VII. A Manifold Quadrantal, hath either three Right Angles and three Sides equal to Quadrants, or two Right Angles, with the two Sides opposite to those Angles, Quadrants. But of these two last we will not treat, as little to our purpose. Only of.

VIII. A Single Quadrantal, which hath one Side only a Quadrant, or one Angle only equal to a Quadrant.

IX. Every Single Right-angled Spherical Triangle, hath annexed to it a Single Quadrantal, whose Parts agree with the Parts of the Right-angled Triangle.

X. A Single Right-angled Triangle, hath either two Acute Angles, or two Obtuse Angles; or lastly, one Acute, and the other Obtuse.

XI. A Right-angled Spherical Triangle, having two Acute Angles, hath all its Sides severally less than Quadrants.

XII. A Right-angled Spherical Triangle, having two Obtuse Angles, hath also two Sides opposing them, greater than Quadrants, and the third Side opposite to the Right Angle lesser than a Quadrant.

XIII. A Right-angled Spherical Triangle, having an Acute and an Obtuse Angle, hath the Side subtending the Acute Angle lesser than a Quadrant, and the other two Sides greater than Quadrants.

XIV. A Spherical Triangle, not Quadrantal, is that which hath none of its Sides a Quadrant, nor any one of its Angles equal to a Quadrant; and this is commonly called an Oblique-angled Spherical Triangle.

XV. An Oblique-angled Spherical Triangle, either consists of pure Acute or Obtuse Angles, or of them mixed together.

XVI. In Obtuse-angled Spherical Triangles, the Angle that is nearest in Quantity to a Quadrant, and the Side subtending it, are doubtful, whether they be of the same, or divers kinds, except the Accompt or Position declare the same.

XVII. The

XVII. The other two Angles, not so near Quadrants, are always of the same kind with the Sides subtending them; therefore of what kind the one is, it appeareth also of what kind the other is.

XVIII. If any Angle of a Triangle be nearer a Quadrant than the Side subtending it, two Sides thereof shall be of one kind, and the third lesser than a Quadrant.

XIX. But if any Side of a Triangle be nearer a Quadrant than the Angle subtended thereby, two Angles thereof shall be of the same kind, and the third greater than a Quadrant.

Section II.

Hitherto of the Kinds and Affections of Spherical Triangles, I will now come nearer to their Calculation, which is nothing else, but the finding out of an unknown Part from three given, by help of the *Golden Rule* of *Proportion.*

I shewed you before, how the Four Terms of a Proportion may be altered, and how any of the Terms may be put in the last Place, which is of that consequence, that I think fit to set it down again; as suppose this Proportion were given, *As* the Tangent of one Extream, *to* the Sine of the Mean; *so* is the Radius, *to* the Tangent of the other Extream; and marked with these Letters, A . B :: *a* . *b* This Proportion may be varied thus, B . A :: *b* . *a* Or, *a* . *b* :: A . B Or, *b* . *a* :: B . A And it matters not how the Middle Terms stand.

The Spherical Triangles to be thus Calculated, are only the Single Quadrantal, and the Not Quadrantal, or Oblique.

All Spherical Triangles are Calculated by the help of Four Axioms, and by continuing the Parts to Quadrants, which being demonstrated in many Books, I will not now trouble you with more that the naming them.

Axiom I. In all Spherical Triangles, whether Quadrantal or no, the Sines of the Sides are proportional to the Sines of their opposite Angles.

Axiom. II. In all Right-angled Spherical Triangles, having the same Right Angle at the Base, the Sines of the Hypothenuses and Perpendiculars are proportional.

Axiom III. In all Right-angled Spherical Triangles, the Sines of the Bases, and the Tangents of the Perpendiculars, are proportional.

Axiom

Axiom IV. In all Spherical Triangles, either Right or Oblique-angled, one side being made the Base,

As the Tangent of Half the Sum of the Cases of the Base,
To the Tangent of Half the Sum of the Legs:
So the Tangent of Half the Difference of the Legs,
To the Tangent of Half the Difference of the Cases.

Section III.

All Spherical Triangles, of what Nature soever, are Calculated by the foregoing Axioms, only that Case, where Three Sides are given to find an Angle, which I will deliver apart.

I shall first begin with Right-angled Spherical Triangles, or Quadrantals, and follow the Method of the Circular Parts invented by the Lord *Neper*; and then deliver the Cases, and Varieties, with Examples.

Resolution of Right-angled Spherical Triangles.

1. There are six Parts in every single Quadrantal, whereof one only is equal to a Quadrantal (and that is quite left out, as being always known) and the other five not Quadrants are only taken notice of.

2. Of these five Parts, three are always Ingredients into the Question; and therefore in a Right-angled Spherical Triangle, marked as you did the Plain one, *viz.* A the Right-angle, B A the Base, C A the Perpendicular, B C the Hypothenuse, B the Angle at the Base, and C the Angle at the Perpendicular, and in a moment you may learn the Parts, by but naming the Letters, and viewing of Figure 1. All which are in the first place distinguished by the immediate Sequency (or following) of the Parts, or the Not-sequency of them. *Fig.* 1.

3. The immediate Sequency is not hindred by the Part equal to a Quadrant, (for as before that is not to be regarded) therefore in the Spherical Triangle A B C, Right-angled at A, these three, B A, C A, C, are said to follow one another immediately, notwithstanding the Right Angle at A; so in the Spherical Triangle B C E, having B E a Quadrant, these Parts, E, B, and B C, are said to follow one another, notwithstanding the Quadrant Arch B E. *Fig.* 1.

4. Take notice, that in this way the Sides B A and C A, next the Right Angle, are taken simply, that is to say, these two Parts are not changed; but the Angles B and C, and the Hypothenuse B C, are taken by their Complements, (or Difference to a Right Angle) and these makes three Parts more, five in all. Of these five (as before) three are at once Ingredients, whereof two are given, and one demanded, and are to be considered, whether they all follow one another and fall together; as (1.) B, B A, and A C; or (2.) B A, A C, and C; or (3.) C A, C, and B C; or (4.) C, B C, and B; or (5.) B C, B, and B A; being five in Number, according to the Parts, wherein B A, A C, C, B C, and B, are the Means, and the other two the Extreams.

Or they fall to be separated, a sunder, or disjunct, *viz.* two are absolutely removed from the third, which is to be accounted the Intermedial; as if I ac- *Fig.* 1.

count

count B A the Intermedial, then is C and B C the Oppofites; if C the Intermedial, then is B and B A the Oppofites; if B C, then is B A and C A Oppofites; if B be an Intermedial, then is C A and C the Oppofites. And this is very well expreffed by D^r *Newton*, in his *Geometrical Trigonometry*, by this Table.

Mid. Part.	*Extreams.*		*Oppofites.*	
B A	B	C A	C	B C
C A	B A	C	B C	B
C	C A	B C	B	B A
B C	C	B	B A	C A
B	B C	B A	C A	C

Where the firft Column is to be accounted the *Means*, or *Middle Parts*, the fecond the *Extreams* conjunct, and the third is the *Oppofites*, or *Extreams* disjunct.

Out of the former Axioms are gathered thefe two Rules:

Rule 1.

As the Radius,
To the Tangent of one of the Extreams conjunct ::
So the Tangent of the other Extream conjunct,
To the Sine of the middle part.

Rule 2.

As the Radius,
To the Co-fine of one of the Extreams disjunct ::
So the Co-fine of the other Extream disjunct,
To the Sine of the middle part.

Therefore if the Intermedial (or middle part) be fought, the Radius muft be in the firft place, if either of the Extreams, the other Extream muft be in the firft place.

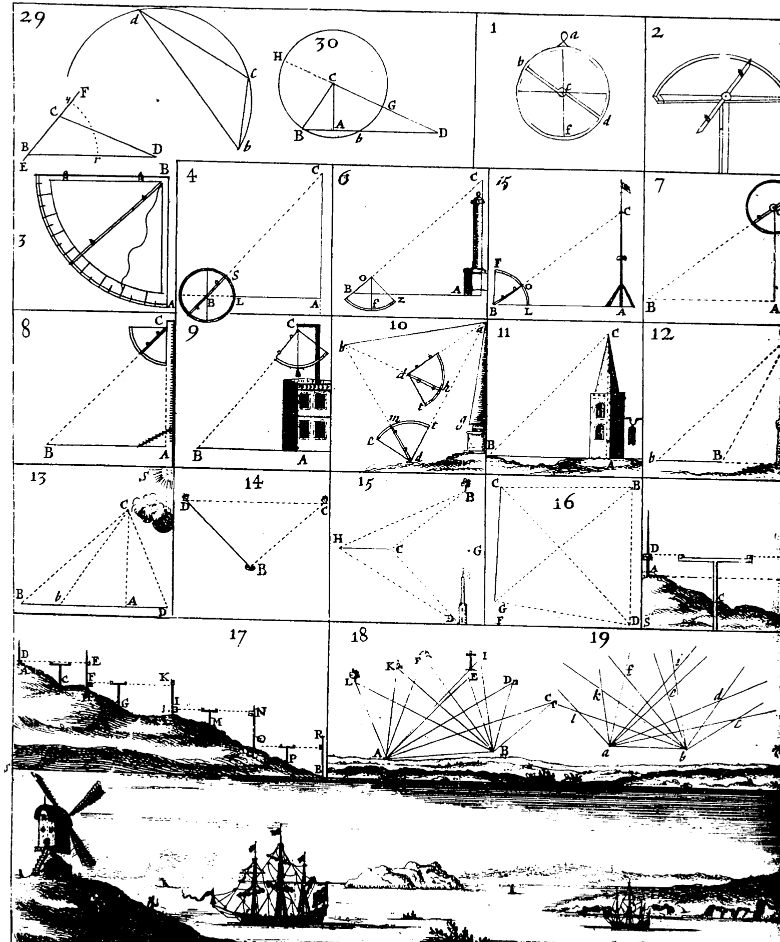
Only Note, That if the Intermedial *(or middle part)* or either of the Extreams adjacent, or (conjunct) be noted with *Comp.* in the Circular parts of the Triangle, inftead of the Sine or Tangent, you muft ufe the Co-fine, or Co-Tangent of fuch part or parts.

If either of the Oppofite Extreams *(or Disjunct)* be noted with its *Comp.* inftead of the Co fine, you muft ufe the Sine of fuch Extream.

Fig. 1. As for Example, In Figure 1, if the Angle at B be 23° 30′, (the Angle of the Ecliptick and Equinoctial) and B C a part of the Ecliptick 34° 40′, and C A the Declination be required. I confider the three Ingredients, which are B, B C, and C A, and find B and B C to be removed from B A, therefore B A is the Middle Part, and B and B C are the Oppofites disjoyned; and then, by the fecond Rule, *As* the Radius, *to* the Co-fine B C; *fo* the Co-fine B, *to* the Sine C A: But you are bid to take the Complements of B and B C; therefore, as in the following Work,

As Radius . *f.* B C :: *f.* B . *f.* B A

As



Page 10

As Radius,	10,000000
to Sine B C 34° 40':	9,754960
So Sine B 23° 30',	9,600699
to Sine C A 13° 7'.	19,355659

Suppose B C 34° 40', or to be 4° 40' of ♉, and B to be the Angle of the greatest Declination 23° 30', I add B C and B, and it makes 19,355659, from which I take the Radius, and it leaves 9,355659, the Sine of 13° 7'.

This would be sufficient, but that I am resolved to be plain, and to make all easie, and therefore I will set down Rules and Examples in all the Sixteen Cases of Right-angled Spherical Triangles, taken from the former Directions, which will be sufficient for the young Practitioner, 'till he be able fully to understand what goes before. Therefore for the Resolution of all these sort of Right-angled Triangles take notice, that for the *Data*, or Things given, there can be but six sorts, *viz.*

I. The Hypothenuse and a Side given: 1. To find an Angle opposite. 2. The other Side. And 3. The Angle comprehended.

II. The Hypothenuse and Angle adjoyning being given: 1. To find the Side opposite to the Angle. 2. The Side adjoyning to the Angle. 3. The other Angle.

III. By a Side, and the Angle opposite to it, given: To find, 1. The Hypothenuse. 2. The other Angle. 3. The other Side.

IV. By a Side, and the Angle adjoyning, given: To find, 1. The other Angle. 2. The other Side. 3. The Hypothenuse.

V. By both the Sides given: To find, 1. The Hypothenuse. 2. Either Oblique Angle.

VI. By both Angles given: To find, 1. The Hypothenuse. 2. Either of the two Sides.

Therefore when any Question is proposed in Right-angled Spherical Triangles, it will fall upon some of these Six Propositions, and the *Data* (which must be two) to seek a Triplicity in the four first Propositions, and a Duplicity in the two last, which makes in all Sixteen Cases. Therefore suppose the Triangle A B C, Figure 2, were proposed, where let B repre- *Fig.* 2. sent the Equinoctial Point, or Angle made betwixt the Equinoctial and Ecliptick, 23° 30', and let B C be a Part of the Ecliptick 34° and 40', or the 4° and 40' of *Taurus*; let B A be the Right Ascension of the Sun 32° 23', C A the Declination 13° 7', and C the Intersection of the Ecliptick and Meridian 70° 19'. Now if any two of these be given to find the rest, you may by the former six Propositions, and these following Cases, resolve them and the like with much ease.

Prop. I. *By the Hypothenuse and Side given,*

1 *To find an Angle opposite.*	*Example.*	
Given { B C, C A. Sought B.	From R and *si.* of C A 13° 7′	19,355659
	Take *si.* B C 34° 40′	9,754960
Rule.		
Si. B C . *si.* C A :: R . *si.* B	Rests *si.* of B 23° 30′	9,600699

2. *To find the other Side.*	*Example.*	
Given { B C, C A. Sought B A.	From R and *co-si.* B C 34° 40′	19,915122
	Take *co-si.* C A 13° 7′	9,988519
Rule.		
Co-si. C A . *co-si.* B C :: R . *co-si.* B A	Rests *co-si.* B A 32° 23′	9,926605

3. *To find the Angle comprehended.*	*Example.*	
Given { B C, C A. Sought C.	From R and *t.* C A 13° 7′	19,367382
	Take *t.* of B C 34° 40′	9,839837
Rule.		
Tan. B C . *t.* C A :: R . *co-si.* C	Rests *co-si.* C 70° 19′	9,527545

Prop. II. *By the Hypothenuse and Angle adjoyning,*

1. *To find the Side opposite to the Angle.*	*Example.*	
Given { B C, B. Sought C A.	To Sine B C 34° 40′	9,754960
	Add the Sine B 23° 30′	9,600699
Rule.	Rests the Sine C A 13° 7′	x9,355659
R . *si.* B C :: *si.* B . *si.* C A		

2. *To find the Side adjoyning to the Angle.*	*Example.*	
Given { B C, B. Sought B A.	From R and *co-t.* B C 34° 40′	20,160162
	Take *co-si.* B 23° 30′	9,962398
Rule.	Rests *co-t.* B A 32° 23′	10,197764
Co-si. B . R :: *co-t.* . *co-t.* B A.		

3. *To find the Angle adjoyning to the other.*	*Example.*	
Given { B C, B. Sought C.	To *co-si.* B C 34° 40′	9,915122
	Add the Tangent of B 23° 30′	9,638302
Rule.	Rests *co-t.* C 70° 19′	x9,553424
R . *co-si.* B C :: *t.* B . *co-t.* C.		

Prop.

Prop. III. *By a Side and Angle opposite,*

1. *To find the Hypothenuse.*	*Example.*	
Given { C A, B. Sought B C.	From R and *si.* C A 13° 7′	19,355659
	Take *si.* B 23° 30′	9,600699
Rule.		
As *si.* B . *si* C A :: R . *si.* B C.	Remains *si.* B C 34° 40′	9,754960

2. *To find the other Angle.*	*Example.*	
Given { C A, B. Sought C.	From R and *co-si.* B 23° 30′	19,962398
	Take *co-si.* C A 13° 7′	9,988519
Rule.		
Co-si. C A . *co-si.* B :: R . *si.* C.	Remains *si.* C 70° 19′	9,973879

3. *To find the other Side.*	*Example.*	
Given { C A, B. Sought B A.	From R and *t.* C A 13° 7′	19,367382
	Take the *t.* of B 23° 30′	9,638302
Rule.		
Tan. B . *t.* C A :: R . *si.* B A.	Rests the *si.* of B A 32° 23′	9,729080

Prop. IV. *By a Side and an Angle adjoyning,*

1. *To find the other Angle.*	*Example.*	
Given { B A, B. Sought C.	Add the *si.* of B 23° 30′	9,600699
	To *co-si.* B A 32° 23′	9,926591
Rule.		
R . *si.* B :: *co-si.* B A . *co-si.* C.	Rests *co-si.* C 70° 19′	x9,527290

2. *To find the other Side.*	*Example.*	
Given { B A, B. Sought C A.	Add *si.* B A 32° 23′	9,728825
	To *t.* B 23° 30′	9,638302
Rule.		
R . *si.* B A :: *t.* B . *t.* C A.	Rest *t.* C A 13° 7′	x9,367127

3. *To find the Hypothenuse.*	*Example.*	
Given { B A, B. Sought B C.	Add *co-t.* B A 32° 23′	10,197766
	To *co-si.* B 23° 30′	9,962398
Rule.		
R . *co-t.* B A :: *co-si.* B . *co-t.* B C.	Rests *co-t.* B C 34° 40′	x9,160164

Prop.

Prop. V. *By both the Sides,*

1. *To find the Hypothenuse.*	*Example.*	
Given $\left\{\begin{array}{l}\text{B A,}\\ \text{C A.}\end{array}\right.$ Sought B C.	Add *co-si.* B A 32° 23′	9,926591
	To *cosi.* C A 13° 7′	9,988519
Rule. R . *co-si.* BA :: *co-si.* CA . *co-si.* BC.	Rests *co-si.* B C 34° 40′	19,915110

2. *To find either of the Angles.*	*Example.*	
Given $\left\{\begin{array}{l}\text{B A,}\\ \text{C A.}\end{array}\right.$ Sought B.	From R and *t.* C A 13° 7′	19,367382
	Take the *si.* B A 32° 23′	9,728825
Rule. *Si.* BA . *t.* C A :: R . *t.* B.	Rests *t.* B 23° 30′	9,638557

Prop. VI. *By both the Angles,*

1. *To find the Hypothenuse.*	*Example.*	
Given $\left\{\begin{array}{l}\text{B,}\\ \text{C.}\end{array}\right.$ Sought B C.	From R and *co-t.* C 70° 19′	19,553547
	Take *t.* B 23° 30′	9,638302
Rule. *Tan.* B . R :: *co-t.* C . *co-si.* BC.	Rests *co-si.* B C 34° 40′	9,915245

2. *To find a Side.*	*Example.*	
Given $\left\{\begin{array}{l}\text{B,}\\ \text{C.}\end{array}\right.$ Sought C A.	From R and *co-si.* B 23° 30′	19,962398
	Take *si.* C 70° 19′	9,913852
Rule. As *si.* C . *co-si.* B :: R . *co-si.* CA.	Rests *co-si.* C A 13° 7′	9,988546

Thus by six Propositions of two Parts given, you may find any Part in a Right Angled Spherical Triangle of any of the sixteen Cases, with much ease and clearness.

For Example.

Fig. 3. If a Question were given where the Hypothenuse was 30°, and one of the Sides or Base 27° 54′ (for you may account either Side for the Base) to find out the Angle comprehended betwixt them. First draw the form of a Triangle, as in *Fig.* 3, mark the *Data* by a small Line, and the Part sought by a Cypher placed upon it; then seeking which of the six Proportions the *Data* will relate to, you will find it *Prop.* 1. and *Case* 3. and the Rule to be, *As* Tang. B C . Tang. BA :: R . co-si. B. which you may work as by the Example following,

From

From Radius, and Tangent B A 27° 54′	19,723844
Take the Tangent B C 30° 00′	9,761439
Rests Co-sine B 23° 30′ (the Angle sought)	9,962405

Lastly to finish the Doctrine of *Right-angled Triangles*, certain Cautions are to be given and observed, as follow.

First, That if the Angle sought for, be Acute, then the Sine or Tangent thereof represents it truly; but if it be Obtuse, then you must take it from 180°, and the Remainder is the Angle: Which must be observed in all, the Reason being, that to every Sine and Tangent a double Angle is answerable, one Acute, the other Obtuse. And the same Rule serves for the Sides likewise, by the like Reason.

Secondly, For knowing whether the Angles sought for be Acute or Obtuse, or whether the Sides sought be greater or lesser than 180 Degrees, observe the following Rules, appropriate to the 6 Propositions and 16 Varieties, as they have been before taught, and there set down.

I. In *Prop. I. Variety* 1. you shall know, whether the Angle sought be Acute or Obtuse; for if the Side given be less than a Quadrant, then the Angle sought will be Acute; if otherwise, Obtuse.

II. In *Prop. I. Var.* 2. the sought Side will be less than a Quadrant, if the Hypothenuse and the Side given are less than Quadrants; but it shall be greater than a Quadrant, if the Hypothenuse be greater than a Quadrant.

III. In *Prop. I. Var.* 3. the Angle sought will be found Acute or Obtuse by the last Observation.

IV. In *Prop. II. Var.* 1. if the Angle given be Acute, then the Side sought will be less than a Quadrant; if Obtuse, then greater.

V. In *Prop. II. Var.* 3. the Angle sought will be Acute, if the Hypothenuse be less than a Quadrant, and the given Angle Acute; but it will be Obtuse, if the Hypothenuse be less than a Quadrant, and the Angle given Obtuse; or contrarily.

VI. In *Prop. III. Var.* 1. the Hypothenuse will be less than a Quadrant, if the other Angles be both Acute, or both Obtuse, or if the Sides be both of one kind.

VII. In *Prop. III. Var.* 2. the Angle sought will be Acute, if the Hypothenuse be less than a Quadrant, and the other Angle Acute.

VIII. In *Prop. III. Var.* 3. the Side sought will be less than a Quadrant, if the Hypothenuse and the Side given be less than Quadrants.

IX. In

IX. In *Prop. IV. Var.* 1. the Angle ſought will be Acute, if the given Side be leſſer than a Quadrant; if greater, Obtuſe.

X. In *Prop. IV. Var.* 2. if the given Angle be Acute, then the Side ſought will be leſſer than a Quadrant; if Obtuſe, greater.

XI. In *Prop. IV. Var.* 3. the Hypothenuſe will be leſſer than a Quadrant, if the given Angle be Acute, and the Side leſs than a Quadrant; and the contrary.

XII. In *Prop. V. Var.* 1. the Hypothenuſe will be leſs than a Quadrant, if the Sides be either of them greater, or either of them leſs than a Quadrant; and contrarily Obtuſe.

XIII. In *Prop. VI. Var.* 2. the Angle ſought will be Acute, if the oppoſite Side be leſs than a Quadrant; Obtuſe, if greater.

XIV. In *Prop. VII. Var.* 3. the Hypothenuſe ſought for will be leſs than a Quadrant, if both the Angles given be either ſeverally Acute or ſeverally Obtuſe; but it will be greater than a Quadrant if the one be Acute the other Obtuſe.

XV. In *Prop. VI. Var.* 2. either of the Sides ſought ſhall be leſs than a Quadrant, if the oppoſite Angle be Acute; greater, if Obtuſe.

But theſe Obſervations need not be regarded, when you ſhall be well verſed in the Sphere or Globe.

Thus you have ſeen, how Right Angled Spherical Triangles and Quadrantals are to be Calculated: I come next to Oblique ones, or not Quadrantals.

SECTION

SECTION IV.

The Calculation of Oblique-angled Spherical Triangles.

THe Calculating Oblique-angled Spherical Triangles is comprehended in ſeven *Problems*, according to the ſeven-fold Variety of the four Parts Ingredients into the Queſtion, as appeareth in this little Table.

In an Oblique-angled Spherical Triangle the four Parts Ingredients into the Queſtion are either

- Oppoſite two to two, that is to ſay, two Angles Oppoſite to two Sides; *& contra.* — *Probl.* 1.
- Or not Oppoſite two to two, the Parts given being either
  - Pure, and that either
    - Three ſides, and then there is ſought either
      - An Angle. — *Probl.* 2.
      - Or the Caſes of the Baſe. — *Probl.* 3.
    - Or three Angles which are reduceable to three Sides.
  - Or not Pure, wherein the Order of Ingredients begins with either
    - An Angle, wherein either
      - One Ingredient is removed from three. — *Probl.* 4.
      - Or all four Ingredients follow immediately. — *Probl.* 5.
    - Or a Side, wherein either
      - One Ingredient is removed from three. — *Probl.* 6.
      - Or all four Ingredients follow immediately. — *Probl.* 7.

Problem

Problem I.

In an Oblique-angled Triangle; of Four Parts oppoſed, Two to Two, viz. Two Angles and Two Sides, any Three being given, to find the Fourth,

THis is the very ſame with the firſt Axiom, Sect. II. hereof, of *Right-angled Triangles*, but that only here is an Oblique Angle in ſtead of the Right Angle there. And therefore the Reſolution is performed by the ſaid firſt Axiom of Proportion, which was this:

As the Sine of any Side,
To the Sine of an Angle oppoſite to it:
So is the Sine of any other Side,
To the Sine of the Angle oppoſite.

Example.

Fig. 4. *In the Oblique-angled Triangle B C D; of theſe Four Parts, B, D C, D, and B C, let any Three be given, and the Fourth be ſought for, ſuppoſe B C.*

As ſi. B 47° 34′,	9,868093	(1)
To ſi. D C 52° 3′:	9,896828	(2)
So is *ſi.* D 34° 39′,	9,754777	(3)
2*d* and 3*d* added	19,651605	(4)
To the *ſi.* B C 37° 25′.	9,783512	(5)

Having ſet down the Proportion, and found the Logarithms by the Canon, I add the ſecond and third Terms, which make 19,651605, and ſubtract from that the firſt, which is 9,868093, and it leaves 9,783512, the Sine of 37° 25′, for the Side B C.

But if you ſhould deſire to avoid Subtraction, it is but taking the Arithmetical Complement of the Logarithm of the firſt Term, and adding all together, it will be the ſame. Now the Arithmetical Complement of any Logarithm is the Remainder to 10, as of 9,868093 the Arithmetical Complement is 0,131907.

This being underſtood, and that by altering the Proportion any other Side or Angle may be found, for if it be, *As ſi.* B . *ſi.* D C :: *ſi.* D . *ſi.* B C, it will be, *As ſi.* D . *ſi.* B C :: *ſi.* B . D C. Again, *As ſi.* D C . *ſi.* B :: *ſi.* B C . *ſi.* D, or, *As ſi.* B C . *ſi.* D :: *ſi.* D C . *ſi.* B, for finding D C, D, or B.

Note, That in the Caſes where the greateſt Side or Angle is required, it is neceſſary, that it be known, whether it be greater than a Quadrant, or not; becauſe an Arch leſſer than a Quadrant, and the Complement thereof to a Semicircle, have the ſame Right Sine, as before.

Problem

Problem II.

In a Spherical Triangle, by Three Sides given, to find an Angle; or by Three Angles, to find a Side.

THis Problem will be of great Uſe in *Aſtronomy* and *Navigation*; for by it the Hour and Azimuth are found, and therefore I will be plain both in the Rule and Example.

Let the Angle C ſought be comprehended betwixt the two Sides, whoſe Sum and Difference I make uſe of in the Example, *viz.* B C and C D: Therefore ſet down the Arithmetical Complements of the Sines of theſe two Sides, *viz.* B C 38° 30′, and C D 70°, and B D the third Side let be 60 Degrees. Fig. 5.

Take the Difference of theſe Sides, which will be 31° 30′, and under them ſet the third Side, whereof take the Sum, which is 91° 30′, and the Difference, which is 28° 30′; take the Half of this Sum, which is 45° 45′, and the Half Difference 14° 15′, and ſet down the Sines as you ſee in the following Example; then add up into one Sum thoſe two Sines and the two Arithmetical Complements, and they will make 19,479165, the Half whereof 9,739582 is the Sine of 33° 18′, which doubled is 66° 36′ for the Angle required. This Example practiſed a few times, will make all eaſie.

B C	38	30	Arithmetical Complement. Sine	0,205850
C D	70	00	Arithmetical Complement. Sine	0,027014
D	31	30	Difference.	
B D	60	00	the third Side.	
	91	30	the Sum of D and B D.	
	28	30	the Difference.	
	45	45	the Half Sum. The Sine	9,855096
	14	15	the Half Difference. The Sine	9,391205
			The Sum of all four Sines	19,479165
			The Half Sum	9,739582

Which is the Sine of 33° 18′, which doubled is 66° 36′, the Angle C.

And if three Angles be given, to find out a Side, if in ſtead of the greateſt Side and Angle, you take their Complements to 180 Degrees, the Angles will be Sides; and Sides, Angles; and to be reſolved as before.

Q Problem

Problem III.

In all Spherical Triangles, whether Right or Oblique-angled, all the Three Sides being given, to find out the Cases made by the Perpendicular falling upon the Side put for the Base, extended if need be; and consequently the Angles and Perpendicular it self.

THE Cases are formed by this Axiom, *As* the Tangent of Half the Sum of the Cases, *to* the Tangent of Half the Sum of the Legs :: *so* is the Tangent of Half the Difference of the Legs, *to* the Tangent of Half the Difference of the Cases.

Fig. 6. As in the Oblique-angled Triangle B C D, Figure 6, where the Base B D is equal to the Sum of the Cases B A and D A: Then it will be, *As* the Tangent of Half B D, (that is, the Tangent of B A and D A divided by 2) *to* the Tangent of D C more by B C :: *so* is the Tangent of D C less by B C divided by 2, *to* the Tangent of D A less by B A divided by 2.

So likewise in the Oblique-angled Triangle *b* C D, where the Base *b* D is equal to the Difference of the Cases D A and B A, it will be, *As* the Tangent of Half B A more by D A, *to* the Tangent of Half D C more by *b* C; *so* is the Tangent of Half D C less by *b* C, *to* the Tangent of Half *b* D, which is equal to the Half of D A less by *b* A.

Example.

In the Triangle B C D, let the Sides be B C 37° 25′, *D C* 52° 3′, *and B D* 73° 50′.

B D is 73° 50′, the Half B D is 36° 55′; D C is 52° 3′, B C is 37° 25′, the Sum of D C and B C is 89° 28′, and the Half of that Sum is 44° 44′.

Now D C less by B C is 14° 38′, the Half is 7° 19′, say therefore by the former Analogy, *As* the Tangent of 36° 55′, *to* the Tangent of 44° 44′:: *so* is the Tangent of 7° 19′, *to* the Tangent of 9° 37′. Now if you add 9° 37′ to 36° 55′, it will give 46° 32′ for the greater Case D A; and if you subtract, it will give the lesser Case B A 27° 18′.

Now by B C and B A, one of the Cases, the Angle B is found, by *Prop. I. Var. 3. of Right-angled Triangles.* And also by D C and D A, the other Case, the Angle D is found, by the said Proposition. The same Resolution is made, if Three Angles were given, by turning the Angles into Sides, as in the last Problem.

Note, I have omitted to set the Logarithms to the Parts in the former Analogy, which you may supply.

We have now done with *Pure* Parts; but if the Parts given be *not Pure*, the Oblique-angled Triangle is to be reduced into two Right-angled Triangles, by letting fall a Perpendicular (according to the Seventeenth Proposition of the First Section of the Third Chapter, and the Two Notes) in such sort, as that in one Right-angled Triangle, two Parts given may be intire, whereof the one being an Angle is to be noted with the Letter B, and the other a Side to be noted with the Letters B C, as in the Triangles Fig. 7, 8, and 9, are to be seen. This being done, the whole Calculation will be performed by the Resolution of these Four Problems following.

Problem IV.

In an Oblique-angled Spherical Triangle, of the Four Ingredients, whose Order begins with an Angle, and One is removed from Three; the two first being given, and either of the two last, to find the other of the two last.

AS in any of the Three Oblique-angled Spherical Triangles, Fig. 7, 8, 9, before, noted with B C D: Fig. 7. 8. 9.

Of these Four Parts, B, B C, B C D, and D; B, B C, and B C D, being given, to find D. Or, B, B C, and D, being given, to find B C D.

This is done by two Operations, for

1. In the Right Angle A B C, there must be found out B C A, by B C and B, which are the Ingredients, and therefore the Analogy will be,

As Radius . Tang. of B :: Co-sine of B C . Co-tang. of B C A.

2. The Angle B C A being thus found, then say,

As Co-sine of B . Sine of B C A :: Co-sine of D . Sine of D C A.

So that if the Angle B C D be given, by comparing it with the Angle B C A, there will be given the Angle D C A, and so the Angle D by the last Analogy.

Examples of this, and the three Problems following, I do omit purposely, that the Practitioner may exercise himself therein; and the rather, because I have set down all the Parts of the three Triangles next before mentioned, the Calculation whereof these Problems declare.

Problem V.

In an Oblique-angled Spherical Triangle, of the Four Ingredients, whose Order begins with an Angle, and all Four do immediately follow one another; the Two first being given, and either of the Two last, to find the other of the Two last.

AS in any of the Three Spherical Triangles last mentioned, and noted with B C D:

Fig. 7, 8, 9. *Of these Four Parts, B, BC, BCD, and CD; B, BC, and BCD, being given, to find CD: Or else, B, BC, and CD, being given, to find BCD.*

This is done by two Operations, for

1. In the Right-angled Triangle ABC, there must be found out BCA, as in the Problem next before, thus, *viz.*

As Radius . Tang. B :: Co-fine BC . Co-tangent BCA.

2. This being so found, then say:

As Co-fine DCA . Co-fine BCA :: Tang. BC . Tang. CD.

So that if the Angle BCD be given, by comparing it with the Angle BCA, there will be given the Angle DCA, and so the Side BC by the last Analogy.

But if CD be given, then by the last Analogy DCA will be found, which being compared with the Angle BCA, there will be found the Angle BCD.

Problem VI.

In an Oblique-angled Spherical Triangle, of Four Ingredients, whose Order begins at a Side, and One is removed from Three; the Two first being given, and either of the Two last, to find the other of the Two last.

AS in any of the Three Oblique-angled Spherical Triangles before recited, and noted with BCD:

Of these Four Parts, BC, B, BD, and DC; BC, B, and BD, being given, to find DC: Or else, BC, B, and DC, being given, to find BD.

This is done by two Operations, for

1. In the Right-angled Triangle ABC, there must be found out BA, by BC and B, which are the Ingredients, and therefore the Analogy is this:

As Radius . Co-tang. BA :: Co-fine B . Co-tang. BC.

Or else by this Analogy:

As Radius . Tang. BC :: Co-fine B . Tang. BA.

2. BA being thus found out, say:

As Co-fine BA . Co-fine DA :: Co-fine BC . Co-fine DC.

So that if BD be given, by comparing it with BA there will be given DA, and so the Side DC, by the last Analogy.

Problem

Problem VII.

In any Oblique-angled Spherical Triangle, of Four Ingredients, whose Order begins at a Side, and all Four do immediately follow one another; the Two first being given, and either of the Two last, to find the other of the Two last.

AS in any of the Three Oblique-angled Spherical Triangles before recited, and noted with BCD: Fig. 7, 8, 9.

Of these Four Parts, BC, B, BD, and D; BC, B, and BD, being given, to find D: Or else, BC, B, and D, being given, to find BD.

This is done by two Operations, for

1. In the Right-angled Triangle ABC, there must be found out BA, as in the Problem next before, thus:

As Radius . Co-tang. BA :: Co-fine B . Co-tang. BC.

Or thus:

As Radius . Tangent BC :: Co-fine B . Tangent BA.

2. BA being thus found out, say:

As Sine DA . Tangent B :: Sine of BA . Tangent D.

So that if BD be given, by comparing it with BA there will be given DA, and so the Angle D, by the last Analogy.

But if the Angle D be given, then by the last Analogy DA will be found, which being compared with BA, there will be found BD.

The Analysis of Oblique-angled Spherical Triangles.

1. BY two Sides and an Angle opposite, or two Angles and a Side opposite, to find the remaining Side or Angle, and the rest, is performed by the first Problem.

2. By all the Sides to find an Angle, or by all the Angles to find a Side, is performed by the second Problem.

3. By two Sides and the Angle comprehended to find the rest, is resolved by the sixth and seventh Problems.

4. By two Angles and a Side adjacent, or two Sides and an Angle adjacent, to find the rest, is performed by the fourth and fifth Problems.

CHAP.

CHAP. V.

Of Cosmography, *and of the Uses of the* Sphere *and* Globes *both* Celestial *and* Terrestrial.

HAving taught you *Practical Arithmetick*, *Geometry*, with the Doctrine of *Plain* and *Spherical Triangles*, they will be to you as so many Wings and Helps, whereby to soar up, view, and consider the Heavens, the stupendious Fabrick of the Creator, so wonderful in all its Parts, that it caused *David* to say, *The Heavens declare the Glory of God, and the Firmament sheweth his Handy-work*; and the Poet *Ovid* intimates, as if Mankind were framed for this End:

Pronáque cum spectent Animalia cætera Terram,
Os Homini sublime dedit, Cœlúmque Tueri
Jussit, & erectos ad Sidera tollere vultus.

I might add Reasons, to perswade every one to this Knowledge, but for you it will be evident enough, that without it no Person can be accounted a Navigator, therefore you must learn.

SECTION I.

The General Definitions *and* Notions *of* Cosmography.

I. COSMOGRAPHY being concerned about the greatest Bodies, and most worthy in the World, the *Heavens*, the *Stars*, and this *Earth* whereon we tread, has its Name rightly given, *viz.* The *Delineation* and *Description* of the *World*, and is right worthily accompted one of the Liberal Sciences. It is divided into two Parts, *Astronomy* and *Geography*.

II. *Astro-*

II. *Astronomy*, being the first Part of *Cosmography*, treats of the Celestial Spheres.

III. A *Sphere* Mathematical, or Globe, is contained under one Superficies, from the middle whereof (called the Center) to the Extream of the said Superficies all Lines drawn are equal. And this may be a Solid Sphere, as the Earth, Sun, Moon, and all the Planets and Stars; or we may conceive it a Hollow Body, which besides the Convex, or outward Superficies, has also a Concave, or inward Superficies, which is likewise equally distant from the Center. And this last is such a Sphere as I am now about to describe, called the *Celestial Sphere*, including all the Celestial Bodies and the Earth within it; which makes me here give notice, that the Celestial Globe is very improper, and not so intelligible to young Learners, unless with this Caution, that the Fancy be informed, that either we may imagin our selves above all the Heavens, or else, which is more proper, that we were in the Center of it, and that the Convex Part were represented by the Concave Shell, where those Constellations and Sines are to be seen. And such Spheres have been made so big, that one might sit in the Center; but lesser are to be had at the Globe-Makers, a Picture or Fashion whereof you have in the first Figure. *Fig.* 1.

IV. The *Parts* of the Sphere are either, 1. sensible and visible, 2. or not. Those Parts which are sensible, I call that which is really so, and in a clear and serene Night may be seen, as the Stars and Milky-way.

V. The *Stars* are either Fixed, or Wandring and Moving. The Fixed Stars are all those Glorious Bodies seen upon the Concavity of the aforesaid Hemisphere, and are to appearance equally distant in the Eighth Sphere, are infinite in Number, but to Sight may be divided into seven sorts or Ranks; the first Classis are the greatest, the second are a little less, the third less, and so to the sixth, the seventh are certain cloudy and dark Stars, (which by the Prospective Glass are seen to be Multitudes and Heaps of Stars in that Space of the Cloud) there being infinite of this sort.

VI. All this Excellent Frame being so infinite in Number and Place, the old *Astronomers* digested and drew the most Notable of them into certain Forms, or Shapes, of Birds, Beasts, Men, and other Creatures, called *Constellations*, the better to remember and fix them in the Mind, whensoever they had occasion to use them; and they are distinguished, either to be on the North side of the Zodiack, in the Zodiack, or on the South side thereof, yet not so intirely, but some Stars will not, or do not light to be within the same Constellations, and therefore are called *Informes*. All which you may observe upon the Globe, and likewise in the six Maps thereof herewith bound at the End of this Chapter.

VII. The

VII. The Constellations on the North side of the Zodiack are 23, *viz.*

Lesser Bear. 1. The *Lesser Bear* of 10 Stars, whereof 2 of the Second, 1 of the Third, 3 of the Fourth, 1 of the Fifth, and 3 of the Sixth Magnitude. This Constellation is next to the North Pole, that Star in the Tip of the Tail will be but 2 Degrees and 14 Minutes from the Pole in the Year 1700, and will come nearer and nearer to the Pole for about 400 Years, when it will be within half a Degree of it, and then it will depart from it again. This is called the *Pole-star*, the Sea-star, because observed by Mariners, and is of the second Magnitude. You must observe, that both in the *Greater Bear*, and in this of the *Lesser*, there are in either of them a Wain, called by us *Charles's-Wain*, made of 7 Stars each, (which is the first thing you must learn) you will find them both expressed in Fig. 2 and 3, in both which the Wain is fancied by 4 Stars, the lower 2 for the Wheels, and the Horses by 3; marked by *a b c d* for the Wains, and *e f g* for the Horses. Here *g* is the Fore-horse for the Pole-star, and *a* for the Brightest in the Wain, called by Seamen the Brightest of the *Guards*, and these are to be perfectly known. To find the Place of the Pole by this Constellation, you may fancy the Pole-star and the next Horse to make an Equilateral Triangle with the Pole, on that Part towards the Bright Star called the *Guard*, and it will point near the Pole it self.

Pole-star.

Fig. 2.

Great Bear. 2. The *Great Bear* of 35 Stars, whereof 7 of the Second, 3 of the Third, 12 of the Fourth, 8 of the Fifth, and 5 of the Sixth. Of those 4 which make up the Wain, that in the Bear's Shoulder called *Dubhe* is marked in Figure 3 with A, and the Wheels with B and D; the Thill-horse called *Alioth* is marked with E, and the other two with F and G, all of the Second Magnitude. Observe, that the two Stars A and B are called the *Guards* likewise of the Greater Bear, and by imagining a Line to be extended by those two Stars, you will find the Pole-star; and also, that the Pole it self lies between the Thill-horse *Alioth* and the Pole-star.

Fig. 3.

Dragon. 3. *Draco*, or the *Dragon*, a Constellation of 35 Stars, that lies wreathing betwixt the two Bears; it has but 1 Star of the Second Magnitude, which follows the last but one in the Tail, it hath 10 Stars of the Third, and is notable, because it hath Stars in every one of the Twelve Signs, and for that the Pole of the Ecliptick lies in the very middle of this Constellation.

Cepheus. 4. *Cepheus*, a King of *Ethiopia*, a Constellation that has not any noted Star either of the First or Second Magnitude in it, it contains 21 Stars.

Bootes. 5. *Bootes*, the Keeper of the Bear, or *Arctophylax*, has in it 32 Stars, whereof 1 is of the First Magnitude betwixt his Legs, called *Arcturus* by the *Greeks*, and *Arimech* of the *Arabs*, a noted Star.

Northern Crown. 6. The *Northern Crown*, or *Ariadne's Crown*, has in it 21 Stars, whereof 1 is of the Second Magnitude, called the Bright Star in the Crown.

Hercules. 7. *Hercules*, with his *Club*, watching the Dragon, contains 62 Stars, whereof none of the First or Second Magnitude, there are 9 of the Third, whereof that in his Head called *Ras Algethi* is the most noted.

Harp. 8. The *Harp*, or *Vultur Cadens*, of 15 Stars, whereof 1 is of the First Magnitude, called *Lucida Lyræ*, or the Bright Star in the Harp.

Swan. 9. The *Swan*, of 40 Stars, whereof 1 is of the Second Magnitude, near the Tail.

Cassiopeia. 10. *Cassiopeia*, who was the Mother of *Andromeda*, and sits here in her Chair, she has in her Breast a bright Star of the Third Magnitude, called *Scheder*; there are in this Constellation only 28 Stars, according to *Baierus* and others.

Perseus. 11. *Perseus*, the Son of *Danae*, cleared *Andromeda*, and brought away *Medusa's* Head; it contains 42 Stars, whereof 2 are of the Second Magnitude, one in his Left side called *Algenib*, the other in *Medusa's* Head called *Algol*, the rest are of the Fourth, Fifth, and Sixth Magnitudes.

Auriga. 12. *Auriga*, the Carter, of 40 Stars, whereof one at his Back of the First Magnitude, called the *Goat-star*, *Hircus*, and *Capella*.

Serpentarius. 13. *Serpentarius*, that holds the Serpent, contains 30 Stars, whereof one of the Second Magnitude in his Head.

Serpent. 14. The *Serpent* of 35 Stars, whereof one only of the Second Magnitude in its Neck.

Sagitta. 15. *Sagitta*, or the *Dart*, of 8 Stars, but none of any considerable bigness.

Eagle. 16. The *Eagle*, or *Flying Vulture*, of 27 Stars, whereof only one is of the Second Magnitude in its Neck, called *Vultur volans*, or *Aquila*.

Dolphin. 17. The *Dolphin*, of 10 small Stars, none of the First or Second Magnitudes.

Lesser Horse. 18. The *Lesser Horse*, containing 4 Stars of the Fourth Magnitude.

Pegasus. 19. *Pegasus*, or the *Flying Horse*, a fair Constellation of 23 Stars, whereof 4 are of the Second Magnitude, that in the Tip of the Wing is called *Markab*, these said 4 Stars make a Square.

Andromeda. 20. *Andromeda*, or the Chained Woman, Freed and Married to *Perseus*, containing 27 Stars, whereof 3 are of the Second Magnitude, the first in the Head, the second in the Girdle, and the third in her Leg.

Triangle. 21. The *Triangle*, of 6 small Stars.

Berenice's Hair. 22. *Berenice's Hair*, of 13 Stars, all of small Magnitudes.

Cor Caroli. 23. *Cor Caroli*, a small Constellation, formerly *informes*, added by the Worthy and Loyal Knight Sir *Charles Scarbrough*, of 3 Stars, situate betwixt the *Great Bear* and the last Constellation *Coma Berenicis*, whereof that of the Second Magnitude is called *Cor Caroli* in Memory of King *Charles* the Martyr.

VIII. The Constellations in the Zodiack are 12, *viz.*

Aries. 1. *Aries*, the *Ram*, the Leader of the Flock, containing 19 Stars; that which is most noted, is that in his Ear of the Third Magnitude, from whence many Astronomical Tables were formerly Calculated, and from this *Copernicus* accompted the Procession of the Equinoctial.

Taurus. 2. *Taurus*, the *Bull*, containing 48 Stars, whereof one in the Bull's Eye is of the First Magnitude, called *Aldeboran*, and by the *Romans*, *Palilicium*; and another in the Tip of his Horn is of the Second Magnitude. This great

Constellation has two smaller Constellations belonging to it, 1. the *Pleiades*, or Seven Stars, in the Bull's Neck; sometimes they are called *Vergiliæ*, because of their Cosmical Rising in the Spring: 2. *Hyades*, which are Five Stars near the Bull's Eye, called sometimes *Suculæ*.

Gemini. 3. The *Twins*, or *Gemini*, a Constellation of 34 Stars, whereof 3 are of the Second Magnitude, the first preceding in the Head is called *Castor*, that in the Neck following is called *Pollux*, and the third is in the Foot.

Cancer. 4. The *Crab*, or *Cancer*, containing 32 Stars, two of them of the Third Magnitude, the rest of the Fourth, Fifth, and Sixth.

Leo. 5. The *Lion*, *Leo*, containing 43 Stars, whereof two are of the First Magnitude, *viz.* the Lions Heart or *Regulus*, and that in the Extremity of the Tail called *Cauda Leonis*, very fair Stars; and two of the Second Magnitude, *viz.* that in the middle of the three in his Neck, and that on the top of his Loins.

Virgo. 6. The *Virgin*, *Virgo*, hath 45 Stars belongs to her, and one considerable of the First Magnitude, in the Virgin's Left-hand, called *Spica Virginis* or *Vindemiator*.

Libra. 7. The *Ballance*, *Libra*, containing 14 Stars, whereof two are of the Second Magnitude, *viz.* one in the Southern Scale called *Lanx Meridionalis*, the other in the very End of the Handle called also *Lanx Septentrionalis*.

Scorpio. 8. The *Scorpion*, containing 35 Stars, one of the First Magnitude in the Body called *Cor Scorpionis*, and of the Second in the Head.

Sagittarius. 9. *Sagittarius*, or the *Centaur*, hath 30 Stars in it, two whereof are of the Second Magnitude, one in the Knee of his Right-leg, and the other in the Heel of the same Leg.

Capricornus. 10. *Capricornus*, containing 28 Stars, but none of them either of the First or Second Magnitude.

Aquarius. 11. *Aquarius*, having 42 Stars in it, but none of any considerable Magtitude.

Pisces. 12. *Pisces*, the *Fishes*, have 36 Stars in them, but none of them either of the First or Second Magnitude.

IX. The Constellations on the South side of the Zodiack, are,

Whale. 1. The *Whale*, or *Cetus*, a Constellation of 29 Stars, whereof two are of the Second Magnitude, one near his Mouth, and another near the Tail.

Orion. 2. *Orion*, a most noted Constellation of 56 Stars, whereof there is one of the First Magnitude in his Left-shoulder of a ruddy colour, and another of the same Magnitude in his Right-foot called *Rigel*; there are four of the Second Magnitude, one in his Right-shoulder, and three in his Girdle in a straight Line called the *Yard Wand*: There are two in the Shoulders before-mentioned, two in his Feet, three in the *Yard Wand*, and three below in the Sword, which fashion this great Warriour, and are very notorious.

Eridanus. 3. *Eridanus*, or the *River*, of 44 Stars, in the Extremity whereof one is of the First Magnitude called *Enar*, the rest are small ones.

Hare. 4. The *Hare*, *Lepus*, of 13 Stars, all small ones.

5. The

5. The *Great Dog*, *Canis major*, a Constellation of 19 Stars, whereof that in his Mouth is of the First Magnitude, a great sparkling Star called *Sirius*, and one near his Left-knee is of the Second Magnitude; the rest are small Stars. Great Dog.

6. The *Little Dog*, *Canis minor*, of 10 Stars, whereof one in his Belly called *Procyon* is of the first Magnitude, the rest are small. Little Dog.

7. The *Ship*, or *Argo Navis*, a Constellation of 51 Stars, whereof one in the Rudder called *Canopus* is of the First Magnitude, and there are seven Stars of the Second dispersed in this Constellation. Ship.

8. *Centaurus*, or the *Centaur*, a Constellation of 41 Stars, wherein there are two of the First Magnitude, one in his Left-thigh, and another in the Extremity of his Right-foot; there are five of the Second Magnitude, the rest small. Centaur.

9. *Crater*, the *Goblet*, is a small Constellation of 11 Stars. Goblet.

10. *Corvus*, the *Crow*, another small Constellation of 8 little Stars. Crow.

11. *Hydra*, the *Serpent*, containing 29 Stars, whereof one is of the First Magnitude called *Alphard* in the third Wreath, and is sometimes called *Cor Hydræ*; the rest are small. Hydra.

12. *Lupus*, the *Wolf*, a Constellation of 20 Stars, all small. Wolf.

13. The *Altar*, *Ara*, of 6 small Stars.

14. The *Southern Crown*, *Corona Meridionalis*, of 13 small Stars. Southern Crown.

15. The *Southern Fish*, *Piscis Notius*, of 12 Stars, whereof one in the Mouth called *Fumahant* is of the First Magnitude, the rest are small Stars. Southern Fish.

16. There are 12 Constellations more towards the South Pole, *viz.* 1. The *Peacock*, *Pavo*; 2. *Toucan*; 3. *Grus*; 4. *Phænix*; 5. *Dorado*; 6. *Piscis volans*; 7. *Hydrus*; 8. *Chameleon*; 9. *Apis*; 10. *Apis Indica*; 11. *Triangulum*; and 12. *Indus*; the which I shortly expect shall be truly rectified and adjusted, as to their Places and Distances, by the industrious and able Astronomer, Mr. *Edmund Halley*, now residing at St. *Helen's* Island for that purpose.

There is besides to be noted, the *Milky-Way*, described upon the Globe round about, and several other little Clouds, or white Spots, the which viewed by a good and long Telescope are found to be very many small Stars together, and infinite in number, so close, that with the bare Eye they disappear, and seem to be a small Cloud and white Way. So that the Number of the Stars mentioned in the former Constellations are not all, nor it may be not the thousandth part of the Stars; for as some Eyes may see more of them than others, so by Glasses still longer than others more are seen, and may be almost accompted infinite.

X. The *Wandring Stars* or *Planets* are 7, and are either greater, as the *Sun* and *Moon*, because of their visible Light; or lesser, and those are either above, or under the *Sun*; those above are three, *Saturn*, *Jupiter*, and *Mars*; those under are two, *Venus* and *Mercury*. Seven Planets.

For the knowing of these Planets, first the *Sun* and *Moon* are notable, but the rest of them are not known from the Fixed Stars, but by their

R 2 irregu-

irregular and different Appearances from them, and by the difference of their Lights, which do not twinkle, and of other Colours to the Fixed Stars.

Now because we shall have ordinary use to name these Planets, I shall set down the Characters by which they are usually signified.

☉ The *Sun*.	♂ *Mars*.
☽ The *Moon*.	♀ *Venus*.
♄ *Saturn*.	☿ *Mercury*.
♃ *Jupiter*.	

SECTION II.

Of the Movements of the Heavens, as to Apprehension.

The first Phænomena, *of the Motion of the Heavens.*

I. THere are two *Phænomena* for the solving these Motions, and rendring the Reasons of them; the first, to consider this Earth and Waters to be in repose in the Center or Middle of the World, and to conceive that the Heavens move about us from East to West, carrying with them all the Stars comprehended under this vast Vault or Hemisphere.

II. That the Fixed Stars turn round about from Noon to Noon, or from Midnight to Midnight, in 24 Hours, (it is true, there is some small alteration, by reason of some other Motion of them, but it is inconsiderable, being but 2 Degrees in 200 Years,) from East to West, which is called their *Diurnal Motion*; this is very visible, and to be apprehended easily; and this is the Eighth Sphere so called, or Sphere of the Fixed Stars.

Saturn. The next Sphere is that of *Saturn*, which is carried about as the rest of the Fixed Stars, but hath a Motion of his own from West to East, so that he accomplisheth it in 29 Years and 183 Days.

Jupiter. The next is the Sphere of *Jupiter*, that contrary to the aforesaid Motion of 24 Hours moves from West to East, so that he makes his Tour in the space of 11 Years and 318 Days.

Mars. The next is the Sphere of *Mars*, that performs his Tour contrary to the Motion of the Fixed Stars in 1 Year and 310 Days.

Sun. The next is that of the *Sun*, which makes his Motion from West to East almost one Degree in a Day, and performs his Tour in 365 Days, 5 Hours, and near 49 Minutes, but is carried along with the rest of the Stars by the First Mover, as before was said.

Venus. Next the Sun is the Sphere of *Venus*, which moves about with the Fixed Stars, but has its own Motion from West to East in about 8 Months.

Next

Mercury. Next to *Venus* is *Mercury*, seldom seen, he makes his Tour from West to East in near 3 Months.

Moon. Lastly the *Moon*, that makes her Tour from West to East in near 28 Days.

This *Hypothesis* of the Stability of the Earth is fitly explained by Figure 4, where you may perceive the Earth to be the Center, and that the several Spheres have their Places one within another, and that the Sphere of the Fixed Stars incloses them all, as the outward part of an Onion incloses all the other Foldings, as I may familiarly hint it unto you.

The second Phænomena, *of the Earths Motion.*

III. The second *Phænomena* or *Hypothesis* for the solving the Motions, is that which is contrary to the former, not that the Fixed Stars and Heavens move about in 24 Hours, but that they all, as the Sun, are in repose and rest, and move not at all; and that this Terraqueous Globe (this Earth, Sea, and Air about it) turns upon its Axis and proper Center in 24 Hours: So then in this *Hypothesis* the Sun is in the Center immoveable, next him is the Orb of *Mercury*, next *Mercury* the Orb of *Venus*, then the Earth with a Circle about it for the Moon, next that is the Orb of *Mars*, next is the Orb of *Jupiter* with four small Moons about it carried with it, and lastly *Saturn* with two small Moons, and above all, at an immense Distance, is the Sphere of the Fixed Stars; as you may perceive by Figure 5, where all these Orbs are made apparent to the Eye.

Of these two *Hypotheses* or Principles, the first was followed by *Aristotle*, *Hipparchus*, *Ptolomy*, and by a great many of Philosophers and others: The second was followed by *Ecphantes*, *Aristarchus*, *Philolaus*, *Plato*, the *Pythagoreans*, and by *Archimedes*; and after it had been almost quite forgotten for many Ages, it was revived by *Copernicus*, and after him by abundance of the ablest Astronomers and Philosophers, and at this day seems to be believed by the *major* part of the *Virtuosi* of the World.

However both these *Hypotheses* do equally, though not so rationally, solve this Spherical Doctrine we are about, but I shall chuse here the old *Ptolemaick*, which is the first of the two before-mentioned, as the most easie and agreeable to you, I am about to instruct, though I approve and allow of the second, as most reasonable and rational.

IV. The next thing I shall endeavour to make out is, That all this Globe of Earth and Water (and therefore fitly termed the *Terraqueous Globe*) is no more than a Point, or the smallest thing imaginable, in respect of the Wideness of the Sphere of the Fixed Stars, and this is certainly intelligible, for these Reasons: 1. That where-ever one is, either upon Land or Sea, there is one half of the full Heaven in sight, and that two Fixed Stars diametrically opposite, the one shall be setting in the West when the other is rising in the East. 2. That all Astronomical Instruments, and all those made for Dialling, that are used upon the Superficies of the Earth, do declare and shew to us the Motion and Place of the Stars, as to our Sense, as if we were in the Center of the Earth. 3. Whereas Globes and Spheres

are

are in triplicate proportion in respect of their Diameters, if the Diameter of the Earth be put for 1, the Diameter of the Heavens (according to *Tycho*) is at least 14000, (but according to others is much greater) that is, the Cube of the Earth 1, will be to that of the Heavens 244,000,000,000. But Unity is insensible to such a vast Number, therefore let me a little fly out, and repeat you *Seneca*'s Words, in his Preface to his *Natural Questions*, *Hoc est illud Punctum, quod inter tot gentes ferro & igni dividitur. O quam ridiculi sunt Mortalium termini! Punctum est illud in quo navigatis, in quo bellatis, in quo Regna disponitis, &c.* Now (according to *Copernicus*) if the Sun should rest in the Center, and the Earth be moved about by its Diurnal, and carried round the Sun by its Annual Motion, not only the Diameter of the Earth, but the Diameter of that great Orb that the Earth is supposed to move in (which is of such a Magnitude, that it certainly contains the Earth's Body 343,000,000,000) will be found nothing, or a Point, in respect of the Firmament of the Fixed Stars.

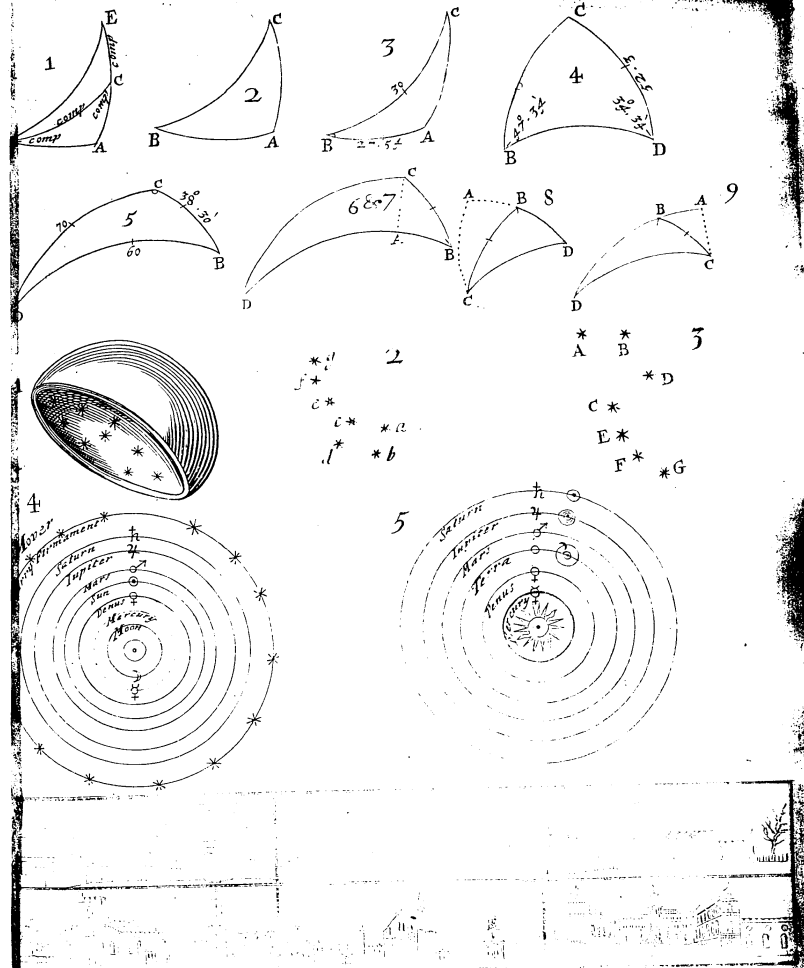
V. That the Earth, as to our Sense, is in the middle of the Heavens, is manifest by the last Proposition, not only in the common opinion of the first *Hypothesis*, but even in that of *Copernicus*; for if the Earth were in the Sun's Place, yet nevertheless by the last Proposition even the great Orb would not be sensible to the Heavens, much less to the Earth.

VI. Having thus declared to you the sensible and visible Parts of the Heavens, and the two *Hypotheses* of their Motions, I come to shew you, what those Circles, Poles, and Points are, which are insensible and invisible, and only feigned and imagined for the better using and understanding of this Work of *Spherical Astronomy*, invented for very good Ends and Uses.

The Circles that are described upon the Sphere are either called *Great Circles*, because they cut the Sphere into two equal Parts; or *Lesser Circles*, which do not. Also every Circle (as has been often told you) is divided into 360 Degrees, every Degree into 60 Minutes, every Minute into 60 Seconds, and so into Thirds, Fourths, &c. though it had been far better to have used the Decimal way, but Custom carrieth it for the Sexagenary. The Circles and Points considerable are these, *viz.*

Horizon. 1. The *Horizon*, which is the first Great Circle observable by every vulgar Person, for being upon a Plain in any fair Day or Night, and looking where the Heavens and Earth part, we see a Circle round about, sometimes called the *Finitor* for that cause, but this Horizon thus found is not the true Horizon, but parallel to it, and therefore called the *Sensible*, *Physical*, and *Visible* Horizon, which I shall treat of in the last Section of this Chapter of *Geography*, and now speak of the *Rational* and *True* Horizon, which is a Great Circle of the Sphere passing by the Center of the Earth, and divides the Heavens into two Halves, *viz.* the *Upper* or *Light* Hemisphere, and the *Lower* or *Dark* Hemisphere. Things at first observable are, that all People see the Sun and Stars rise and set upon this Line, the middle betwixt which we call the *Meridian* or *South*, and the Point opposite the *North*, the

True Horizon. *Upper, light, and visible Hemisphere.* *Rising and Setting.* *South, North.*



between page 102 and 103 Cosmog:

the middle betwixt these Points are the *East* and *West*; so that the Horizon is divided thus into four Quarters, and these four Points are called the *Cardinal Points* of the Horizon, but as People grew more curious, and for that venturing upon the Sea they had more need of a more exact Division, they first divided these four into four again, having the Name from each Cardinal on either side, the South and North still accounted the chief, and these are, *South-East*, *South-West*, *North-East*, *North-West*, so now the whole is thus divided into eight Parts or Divisions. Again these were divided into Halves, making sixteen in all, and taking their Names from the next two of either side, as *North North-East*, *North North-West*, *East North-East*, *West North-West*, and then from the South, *South South-East*, *South South-West*, *East South-East*, and *West South-West*. Lastly, these sixteen were again divided into Halves, called *By-Points*, from the Cardinal Points, as from the North, *North and by East*, *North and by West*, &c. All which are seen in every Mariners Chard, and you may both see and learn them from Figure 6, where they are clearly expressed. As for Example, *c* is the Center of the Horizon, *s n* the Line of South and North, *e w* of East and West, *a f* the Line of South-East and North-West, and *g h* of North-East and South-West.

East and West.

South-East, South-West, North-East, North-West.

Fig. 6.

This is one Division of the Horizon into 32 Parts, which all Navigators observe, and generally go to no more exactness, but Astronomers and Spherical Men go to a far greater niceness and exactness, for they divide it not only into Quarters or Quadrants, but every Quadrant into 90 Degrees, and every Degree into 60 Minutes, and into more if required; so that the whole Horizon is divided into 360 Degrees, and those Degrees into Minutes, &c.

The very Center of this Horizon is the Place of Observation, and a Line of Direction perpendicular to it passeth through to the Point Perpendicular over our Head, which is called the *Zenith*, and another quite under our Feet, which is called the *Nadir*, which are the two Poles of the Horizon, and are 90 Degrees distant from it. If from the Zenith to every Point or Part of the Horizon, whether greater or smaller Divisions, there pass Circles, they are called *Vertical Circles*, and may be as many as you will imagin; that which passeth by the South Zenith and North is called the *Meridian*, and that Circle which passeth by the Points of East and West is called the *Prime Vertical*, and all the rest are called *Azimuths*, or Circles shewing the Position of any Point of the Heavens, in respect of the Horizon and Cardinal Points.

Zenith.

Nadir.

Meridian.

Prime Vertical.

Azimuths.

If Circles be drawn through every Degree and Part of these Vertical ones, parallel to the Horizon, they will be all Lesser Circles upon the Sphere, and decrease toward the Zenith to a Point: These are called *Almicanters*, and shew in the Sphere how far any Point in the Heavens is high, or distant from the Horizon.

Almicanters, or Circles of Height.

This Circle of the Horizon shews the Rising and Setting of the Stars or Planets; for when they come up from the dark Hemisphere they are are said to rise, and contrarily when they go down are said to set.

Rising and Setting.

And

Amplitude Ortive and Occasive.

And upon this Circle the Distance of the Rising of any Star or Planet from the East Point, or the Setting from the West Point, in Degrees and Minutes, (or grosly upon the Points of the Compass before described) is called the *Amplitude Ortive* for Rising, and *Occasive* for Setting.

Artificial Day and Night.

The Horizon is the Cause of the Artificial Day and Night, for we call the Time wherein the Sun abideth above the Horizon an *Artificial Day*, and the Time that he continueth under it the *Night*. Many other Uses are made of this Circle, which I shall hereafter declare; but I will come next to,

Meridian.

2. The *Meridian*, a great Circle of the Sphere, passing the Points of South, and North, and Zenith of the Horizon, and cuts the Sphere or Globe into two Parts or Hemispheres, the Eastern and Western: The *Eastern* Hemisphere is all that Part of the World which is on the East side of the Meridian, and the *Western* is that Part on the West.

Eastern and Western Hemispheres.

Poles of the Meridian.

The Meridian cuts the Horizon at Right Angles, and they two divide the World into four Quarters, and the Poles of the Meridian Circle are in the Horizon in the Points of East and West, and lastly the Meridian and Prime Vertical before described make four equal Quarters of the World.

This Circle divides the Artificial Day and Night into two equal Parts, and shews Mid-day and Mid-night, and when the Stars and Planets are at the highest, or in the Meridian, and are called the *Meridian Altitudes* of the Sun and Stars, which Heights are chiefly observed by Astronomers and Seamen with all diligence.

Natural Day.

Astronomers begin their Accompt of Time (which is measured by the equal Motion of the Equator) from the Meridian: The principal of which Time is the *Natural Day*, which is usually begun from Mid-day or Mid-night, and divided into 24 Hours, and each Hour subdivided into Minutes, Seconds, &c.

Poles Height or Latitude.

The *Poles* of the World are fixt in this Meridian, and in this Circle are observed and accompted the *Latitudes* or Height of the Poles and of the Equinoctial; for the Height of the Pole or Equinoctial, is nothing else but the Arch of the Meridian, contained between the Pole or Equinoctial and the Horizon, and the Height of the Pole is always equal to the Latitude of the Place, and the Height of the Equinoctial is equal to the Complement of the Latitude, and therefore it being subtracted out of 90 Degrees, there shall remain the Height of the Pole.

Now these two Circles of the Sphere, the Horizon and Meridian, joyning together in the Points of South and North, and being immoveable, and certain to one Place, support the whole Spheres and Globes; and being thus particularly described, I will come to the Moveable Circles, which are Great Circles, the *Equinoctial*, the *Ecliptick*, the two *Colures*, and the Circles of *Longitude*.

Equinoctial.

3. The *Equinoctial* or *Equator*, a great Circle, which incompasseth about the midst of the Sphere or Globe, and is every where of equal distance from both Poles, and has its Name from that Position, or else, because the Sun coming under this Circle makes Equality of Days throughout the whole World.

It

Division.

It is divided into 360 Degrees (as all Circles are used to be) beginning where the Ecliptick crosseth in the first Point of the Sign *Aries*, proceeding from 10 Degrees to 20, and so Eastward 'till you come about to the same Point again. This Circle hath many Uses, for,

First, it is the *Measure* of the *First Motion*, for this only of all the Great Circles of the Sphere or Globe is moved equally both in a Right and Oblique Sphere, because the Axis of the World, about which all are turned about equally, is perpendicular thereunto.

Time.
Days.
Hours.
Minutes.

Secondly, it is the Measure of *Time*, because it measures the Quantity of Artificial and Natural Days, of which Months and Years are made: It measureth also the Quantity of Hours, and of other Times, which the Sun makes going under the Ecliptick, and therefore the Degrees of the Equinoctial are called *Tempora*, Times: After which Accompt, the whole is divided into 24 Hours, 15 Degrees thereof to an Hour, for 15 times 24 makes 360. Every Degree of the Equinoctial is 4 Minutes of Time, because 4 times 15 is 60 Minutes, or an Hour.

Equinoctial Points.

Thirdly, it sheweth the two *Equinoctial Points* of the Ecliptick, for seeing it cutteth the Ecliptick in two Places, which are in the Beginning of *Aries* and *Libra*, the Sun when he cometh to those two Points is equally distant from both the Poles of the World, and makes equal Days and Nights as before-said, which falls after our Accompt about the Tenth of *March* and 13 of *September*.

Fourthly, the Irregularities of the Rising and Setting of the Zodiack, and of the Signs and other Parts thereof, are measured by this Circle; for seeing the most part of the Apparences are referred to the Zodiack, and the Zodiack it self is not turned about upon its own Poles, but about the Poles of the Equinoctial, and therefore must needs be unequally turned about, and needful it was to regulate it hereby. Hence come the Names of *Right Ascension*, *Oblique Ascension*, *Ascensional Difference*, which are thus defined:

Right Ascension.

The *Right Ascension* of the Sun, any Star, or Point of the Heavens, is the Arch of the Equinoctial Circle contained betwixt the Beginning of *Aries* and the Meridian which cutteth the Sun, Star, or Point, being first brought under the fiducial Edge thereof, and this either in Degrees, or in Time, allowing 15 Degrees to an Hour, as before was taught.

Oblique Ascension.

The *Oblique Ascension*, is the Arch of the Equinoctial intercepted betwixt the Beginning of *Aries*, and the Horizon, when the Sun, Star, or Point, is likewise brought to the Edge of the Horizon.

Ascensional Difference.

The *Ascensional Difference*, is the Difference of the Right and Oblique Ascensions, and may be had by subtracting one of them from the other, and all these are to be had either in Degrees or Time.

Northern and Southern Hemispheres. Poles Artick and Antartick.

Fifthly, the Equinoctial divides the Globe or Sphere into two equal Hemispheres, the *Northern* and the *Southern*, and the Poles of this Circle are the Poles of the World, one called the *Artick* or the North Pole, the other *Antartick* or South Pole; from which Poles the said Circle is distant 90 Degrees.

Sixthly,

Meridians.

Sixthly, If from the North Pole to every Degree of the Equinoctial, and so to the South Pole, Circles be drawn, these are called *Meridians* or *Hour-Lines*, the chief whereof is the Great Meridian or Twelve of the Clock Hour-Line, that passeth by the Zenith and the South and North Points of the Horizon, in the Globe and Sphere. These Meridians are supplied by the Hour-Circle, which is fixed upon the Meridian, and has the Pole for the Center, and has a moveable Index, which turns as the Globe doth, and fits instead of all those Meridians before-mentioned, which in the laying down of the Globe *in plano* is omitted, and all or most of the Meridians are drawn; therefore it will be of great use to explain this, and that the young Scholar may fully understand, how this Hour-Circle and Index are supplied in the Draughts and Uses of the Globe *in plano.*

Hour-Circle.

Seventhly, Upon the Globe or Sphere, if at every Degree upon the Great Meridian, or all the Meridians, there be Circles drawn parallel to the Equinoctial, they will decrease to nothing at the Poles, and these are called *Parallels of Declination*, and shew what Declination any Planet, Star, or Point, hath from the Equinoctial, the Complement whereof is the Distance of that Star or Point from either of the Poles; if that Planet, Star, or Point, be in the Northern Hemisphere it is called *North Declination*, if in the Southern, *South.* The Declination therefore, is nothing but the Distance from the Equinoctial in Degrees and Minutes, accounted upon the Great Meridian, or upon any other Meridian.

Parallels of Declination.
Declination.
North.
South.

Eighthly, The two Parallels, that are 23 Degrees and an half from the Equinoctial on either side, are called *Tropicks* from turning, for there the Sun turns back again from either of them towards the Equinoctial. That which is in the Northern Hemisphere is called the Tropick of *Cancer*, the other on the other side is called the Tropick of *Capricorn.*

Tropicks.
Tropick of Cancer.
Tropick of Capricorn.

Other two of these Parallels, which are 23 Degrees and an half from the Poles, are described on the Globes; that towards the North Pole is called the *Artick Circle*, the other on the South side the *Antartick Circle.*

Artick Circle.
Antartick Circle.

Lastly, These Tropicks shew the Tropical or Solstitial Points of the Ecliptick, which I am next to describe, they bound the greatest Declination of the Sun, in an Oblique Sphere they point out the shortest and longest Artificial Days. And to the end you may the better understand what has been said, both of the Equinoctial, the Meridians, and Parallels, and likewise of the Horizon, Azimuths, and Almicanters, for in each Case they are alike, and alike situate; I have drawn the Fashion of them in Figure 7, where *a b* may represent the Half of the Equinoctial divided into twice 90 Degrees, then let *c* be the North Pole, and *d* the South Pole, those Circles which come from either Pole will be the Meridians, and pass by every 10 Degrees of the Equinoctial, the other straight Lines are the Parallels, *m n* may be the Tropick of *Cancer*, and *p q* that of *Capricorn*, distant 23 Degrees and an half from the Equator; the upper Half is then the Northern Hemisphere, and the lower the Southern; the outermost Circle is the Great Meridian of Twelve of the Clock; even so for the Horizon, let the outermost Circle be the Meridian of Twelve as before, then

Fig. 7.

then let *a b* be the Horizon, so will the Hemisphere *a c b* be the light Hemisphere, and *a d b* the dark, *c* will be the Zenith, and *d* the Nadir: Those Circles which were Meridians before, are now Vertical Circles or Azimuths, and come through the Horizon to the Nadir; and those straight Lines which were Parallels before, do now become Parallels to the Horizon, or Almicanters. These will be of great Use to be learnt and well understood, and will much facilitate the Work of the Uses of the Sphere. We come now to

Zodiack.

4. The *Zodiack*, which is a broad Circle of about 14 Degrees, and encompasseth about the Sphere obliquely like a Belt or Girdle, coming nearer the Pole of the Sphere in one Place than in another. In the midst of this Zodiack is a great Circle drawn, which is called the *Ecliptick Line*, *Via Regia*, or the *Sun's Way*: This Ecliptick is drawn upon the Globe, and not the Zodiack, it crosseth the Equinoctial in two Points, called the *Equinoctial Points*, and is divided into 12 Parts called *Signs*, and every Sign into 30 Degrees, so that the whole is divided into 360 Degrees, and each Degree into Minutes, &c. it is graduated from West to East beginning at *Aries.* The 12 Signs are, 1. *Aries*, its Mark ♈, 2. *Taurus* ♉, 3. *Gemini* ♊, 4. *Cancer* ♋, 5. *Leo* ♌, 6. *Virgo* ♍, 7. *Libra* ♎, 8. *Scorpio* ♏, 9. ♐ *Sagittarius*, 10. *Capricorn* ♑, 11. *Aquarius* ♒, and 12. *Pisces* ♓. These things are to be noted:

Ecliptick.

First, The Signs are not to be confounded with the Constellations of the same Name, for the Constellation of *Aries* is another thing to the Sign of *Aries*; the one has the Picture of a Ram, wherein 19 Stars are placed, as before was taught; but the Sign of *Aries* is only 30 Degrees of this Ecliptick imaginary Line, from the Equinoctial to the Beginning of *Taurus*, and numbred to 30 Degrees from the Equinoctial: And what I say of *Aries* you may account of all the rest of the 12 Signs. It is true, these Signs and the Constellations were near unto one another some thousands of Years since, but the Fixed Stars, by their Motion upon the Poles of the Ecliptick, though slowly, have (as you will find upon the Globe) removed the Constellation of *Aries* near upon 30 Degrees forwards into *Taurus*, and the Constellation of *Pisces* the like into the Sign of *Aries*, and so of the rest; which deserves to be considered, lest you fall into a Mistake. Peruse Figure 8, and you will learn the Name, Figure, and Mark of the 12 Signs of the Ecliptick.

Fig. 8.

Secondly, The Ecliptick has two Poles, one on the North side, and another on the South, 23 Degrees 30 Minutes from the Poles of the World, and so much doth the Ecliptick lye obliquely from the Equinoctial, and so much is the Angle that the Ecliptick makes with the Equinoctial.

Thirdly, The Meridian that passeth by the Beginning of the Signs *Aries* and *Libra* is termed the *Equinoctial Colure*, and that Meridian which passeth by the Beginning of the Signs *Cancer* and *Capricorn* is called the *Solstitial Colure*, and this Colure passeth likewise through the Poles of the Ecliptick. These two Colures divide the Ecliptick, and indeed the whole Globe into four Parts. That Quarter betwixt the Beginning of *Aries* and Beginning of *Cancer*, contains 3 Signs ♈, ♉, and ♊, or thrice 30 Degrees, equal to

Equinoctial Colure.
Solstitial Colure.

Quarters of the Year. Spring. a Quadrant or 90 Degrees, and whilst the Sun is under this Quarter, the Days are longer than the Nights; and this may be called the *Vernal* or *Spring Quarter*, and as long as the Sun is here, which is most of *March*, all *April* and *May*, is accounted the First Quarter of the Year. The next, of *Cancer* to *Libra*, ♋, ♌, ♍, is *Æstas*, or the *Summer Quarter*, *June*, *July*, and *August*. The next, from *Libra* to *Capricorn*, ♎, ♏, ♐, is the *Harvest Quarter* or *Autumnus*, *September*, *October*, and *November*. The fourth and last, from *Capricorn* to *Aries*, ♑, ♒, ♓, is the *Winter Quarter*, called *Hyems*, and falls in *December*, *January*, and *February*. In the two first, the Days are longer than the Nights; in the two last, the Nights are longer than the Days. And note, That every Quarter is divided as before into 3 Signs, or into 90 Degrees.

Summer. Autumn. Winter.

Fourthly, It is very necessary the young Student have an apprehension, how the Motion of the Sun is made under the Ecliptick, for he must know, that the Sun, though he be carried by the First Mover, as is commonly apprehended, along with the rest of the Heavens, from East to West round in 24 Hours, yet by his own particular Motion from West to East he moves about a Degree in every 24 Hours, and performs his whole Tour in 365 Days, 5 Hours, and near 49 Minutes. A better representation on the Sphere or Globe cannot be made, than by placing a small Fly or Lowse upon the first Point of *Aries*, and then turn the Globe about from East to West one whole Turn, or 24 Hours, and if the Fly creep in the mean time one Degree, or be imagined so to do, and so for every Degree one Turn, you will then easily perceive the Motion, and that whilst the Sun moves thus up the first Quarter to *Cancer*, he draws nearer to the North Pole and lengthens the Days, in the second and third he draws nearer to the South Pole and shortens the Days, in the fourth and last Quarter he lengthens as in the first.

Thus the Suns proper Motion is made, not upon the Center of the Earth, (for then the Sun's Body would appear always to have one and the same Diameter) but upon another Center, as all the Planets do, which shall be particularly explained in the Last Part.

The other Motion from the *Primum Mobile* is likewise fully and clearly to be apprehended, how the Sun and all the Stars are carried about in their several Parallels, (though indeed it be spirally) but being broken off under the Horizon, as to our sight, we represent them by one of the Parallels to the Equinoctial, which by the Ninth Figure will be made more plain to the Understanding, where the two Motions are considered, for if the Sun had only one from West to East, then he would keep one Parallel, and never change the Seasons of the Year; but that he has two may in a few Days be perceived; and if you consider, that when a Ship is under Sail, and goes a swift course, the Passengers walk upon the Deck a contrary Motion without any confusion, where is then two Motions made, one progressive with the Ship, the other back otherwise, as in the said Figure 9, where let the Globe or Sphere be moved upon the two Poles F and G, which are immoveable, suppose the Sun be in H, in the moveable Circle H I B, which let represent the Ecliptick, it is evident, that the Sun being in H, and turning about in 24 Hours, will describe a Parallel (to the Equinoctial C E D) which is H K by the Point H. But when the Sun by his own Motion has advanced from H to L, by his proper Motion he will not describe the Parallel H K, but another L M, 'till at last he arrive at the Point E, equally distant from the Poles F G. Then by his Diurnal Motion he will describe a great Circle of the Sphere, which is the Equinoctial C E D. Lastly, when the Sun shall arrrive at the Point B, he will describe the Parallel A B, and so he will rise again on the other side, 'till he come to H, describing the same Parallels again. The lesser Circles H K and A B are the Tropicks. Fig. 9.

So that the Sun advanceth every Day about a Degree in the Ecliptick, and changeth his Declination or Distance from the Equinoctial, and consequently his Height at Noon, and the Place of his Rising and Setting on the Horizon.

Fifthly, The Sun making his Motion exactly under the Ecliptick Line, I must explain to you why the Zodiack is made so broad, for that the rest of the Planets, *viz.* ♄, ♃, ♂, ♀, ☿, and ☽, do not keep under the Ecliptick Line, but have several Circles of their own, which cross the Ecliptick, but seldom exceed 7 Degrees of either side from it, and so wide is the Zodiack made to contain 14 Degrees, in which Zodiack the rest of the Planets are to be found by their Longitude and Latitude. You must therefore know, that the Ecliptick's Poles are placed in the Solstitial Colure, 23 Degrees 30 Minutes from the Pole; and even as from the Poles to the Equinoctial the Meridians are drawn, so from the Poles of the Ecliptick, if Circles be drawn to the Ecliptick, those are called *Circles of Longitude*, and all Circles parallel to the Ecliptick are *Circles of Latitude*, and all the Planets, Stars, or Points, are limited by these Circles to be so much in Longitude, *viz.* in what Degree and Minute of the Ecliptick, whether in *Aries*, *Taurus*, &c. and so much in Latitude, that is, how far from the Ecliptick, either towards the North, and then it is *North Latitude*, or to the South, and then *South Latitude*. Poles of the Ecliptick. Longitude. Latitude. North. South.

Having (I hope) cleared your Judgments, from mistaking the Signs for the Constellations, you must know, that ♈, ♉, ♊, ♋, ♌, and ♍, are Northerly Signs, the rest ♎, ♏, ♐, ♑, ♒, and ♓, are Southerly Signs, on the South side of the Equator.

Likewise ♑, ♒, ♓, ♈, ♉, and ♊, are Signs ascending, in which the Sun is still approaching to us, and towards the North; ♋, ♌, ♍, ♎, ♏, and ♐, are Signs descending.

Sixthly and Lastly, The Ecliptick is a great Circle, dividing the Globe or Sphere into Halves; it measures the Movements of the Planets, and they are placed within its compass, and are there to be found by their Longitude and Latitude. The Eclipses of the Sun and Moon are here limited and found, and many other Uses, which hereafter will more fully appear.

5. I will now say something of the Motion of the Moon, the Reason of the Eclipses of the Sun and Moon, of the Rising and Setting of the Stars, of

of Time and that which appertains thereto; and lastly, I will sum up in brief what has been here delivered of the Sphere, and then come to the particular Uses thereof.

Of the Moon. I. The Moon has a particular Ecliptick to her self, which crosseth the Sun's Ecliptick in two places, that which comes to the Northward is called the *Head* of the Dragon, that to the South the *Tail* of the Dragon. *Dragon's Head and Tail.* The Moon's Ecliptick bendeth obliquely from the Sun's, and makes the Angle about 5 Degrees, so that as the Sun's Ecliptick declineth from the Equinoctial 23 Degrees 30 Minutes, in like manner these two Eclipticks do 5 Degrees.

So then the Moon moving in her Circle, near 13 Degrees each Day, she will go her own Ecliptick about in near 28 Days. But the Moon has some other Motions, which I defer 'till I treat of her in the Last Book.

Change of the Moon. The Moon is seen after her Conjunction with the Sun (which is commonly called the Change) sometimes in two Days, and sometimes not before the fourth Day, which falls out for three Reasons, the first, because of her Obliquity; the second, by reason of her Latitude; the third, by reason of the unequal Motion of the Zodiack; which will be made clear in the Fourth Part or Book.

Phases. Fig. 10. The *Phases* of the Moon, or the several Shapes which she makes in one Revolution from the Sun, are gathered from the Tenth Figure; where let the Earth be A, ☉ the Sun; then have you 8 Phases, F will be the Full of the Moon, B is the Change when the Moon cannot be seen, D and *d* the Quarters; and so at any time of her Motion you will see her Face how to us, though the Sun doth enlighten more than half of her, because much bigger than the Moon.

Of Eclipses. II. An *Eclipse* is the Obscuration of a Celestial Body from our sight, by interposition of some dark Body, and is generally taken notice of by us in the Sun and Moon.

Eclipse of the Sun and Moon. The Eclipse of the Sun is made by the interposition of the Moon betwixt us and the Sun's Body, the Sun not concerned. The Eclipse of the Moon is an obscuration of the Moon's Body, by passing into the Shadow of the Earth made by the Sun, which will appear plainly if you consider Figure 11, *Fig. 11.* where from the Earth the Moon takes away the Sight of some part of the Sun's Body, which we call the Eclipse of the Sun; and in Figure 12, *Fig. 12.* the Moon passing into the Earth's Shade made by the Sun is totally Eclips'd.

Rising and Setting. III. The *Rising* of a Star is when it appears above or at the Horizon on the East, and *Setting* on the West; and they are distinguished into *Poetical* and *Astronomical.* The Poetical is either *Cosmical Rising*, when any Star riseth at the same Moment that the Sun doth upon the Horizon; or *Cosmical Setting*, which is when any Star sets at the Moment when the Sun riseth. *Cosmical Rising and Setting.* *Cronical* or *Evening Rising*, is when any Star riseth, the Sun setting. *Cronical Setting*, is when any Star sets with the Sun. *Cronical Rising and Setting.* *Heliacal Rising*, is when any Star, having been hid under the Sun's Rays, doth begin to appear. *Heliacal Setting*, is when a Star comes to be hid in the Sun's Rays. *Heliacal Rising and Setting.*

Astro-

Astronomical Rising and Setting. Astronomical *Rising* and *Setting*, is the Ascension or Descension of any Sign of the Ecliptick compared with the Equator, and is termed *Right* when a greater portion of the Equator riseth or setteth than the Degrees of the Sign; and *Oblique*, when a less.

Time. IV. *Time* is either *Astronomical* or *Civil*, and is a certain Measure depending upon the Motion of the Luminaries, by which the Distance and Duration of things are measured.

And first, The *Astronomical Time* is that which is simply taken from the Motion of the Stars, and is a *Day* either *Natural* or *Artificial.* A Natural Day is the Time determined by the Sun's Motion in 24 Hours; an Artificial Day is the Time betwixt the Sun's Rising and Setting, to which is opposed the *Night*, that is the Time the Sun is under the Horizon, and is *equal*, that is of 12 Hours, when the Sun is in the Beginning of *Aries* and *Libra*, or *unequal*, when the Days are longer or shorter than the Nights, as in all the rest of the Signs; the longest Days and shortest Nights are when the Sun is in the Beginning of *Cancer*, and the contrary in *Capricorn.* *Natural and Artificial Day.* *Equal and unequal.*

Hours. The Parts of the Days and Nights are *Hours*, the Day containing 24 Hours, and every Hour being divided into 60 Minutes, and every Minute into 60 Seconds, *&c.* and they begin to be numbred either from the Meridian or Horizon. Those that begin from Noon, and so to Noon again, of 24 Hours, are called *Astronomical Hours*, because Astronomers use these Hours in their Practice. *Astronomical.* But we, and many other *Europeans*, reckon but 12, *viz.* from Noon to Midnight 12, and from Midnight to Noon other 12 Hours.

Those that account their Hours from the Horizon, begin either at the Sun's Rising or Setting; if from the Sun's Rising, then they are called *Babylonish Hours*, and accounted from the Sun's Rising to it again 24 Hours: *Babylonish.* But those that account the Day from the Sun's Setting to its Rising again, and divide that space into 24 Hours, (as is now done in *Italy*) are called *Italian Hours.* *Italian.*

There is yet another Division, (as the *Jews* of old) that is the Day and Night, whether shorter or longer, from Sun's Rise to Sun's Setting, and so the Night is divided into 12 equal Parts, and these are called *Jewish Hours*, and are termed the *first* Hour, *second* Hour, *third* Hour, *&c.* of the Day or Night. *Jewish.*

Month Periodical. Time that is accounted from the Moon, is termed a *Month*, and is either *Periodical*, which is the Time the Moon is making from any Point of the Ecliptick to it again, which is in 27 Days and about 8 Hours; or *Sinodical*, which is from New Moon to New Moon in 29 Days and some odd Minutes. *Sinodical.*

Time that is accounted from the Sun's Motion is that of a Year, and is either a *Sidereal Year*, wherein the Sun departing from a Fixed Star returns to it again, and that is in 365 Days 6 Hours and 9 Minutes; or a *Tropical Year*, which is the Space wherein the Sun passeth from any Point of the Ecliptick to it again, and that is in 365 Days 5 Hours and 12 Minutes. *Year Sidereal. Tropical.* This Year again is divided into 12 Months by the *Romans*, *viz. January*, *February*, *March*, *April*, *May*, *June*, *July*, *August*, *September*, *October*,

November,

November, and *December*; and the Days in each Month are known by these *English* Verses.

Thirty Days hath September,
June, April, *and* November:
All the rest have Thirty One,
Except February *alone*.

February in the Leap-Year has 29 Days, in the other 28. Whilst the Sun performs his Course under the Ecliptick in this Year, in every Month he enters into some one of the Twelve Signs of the Ecliptick, and what Day of the Month in general (for I speak not exactly) that shall be, these two *Latin* Verses will shew near enough for common use, taken out of *Metius*.

♒ ♓ ♈ ♉ ♊ ♋
Gaude, Christus adest, Titan aptissimus exit,
♌ ♍ ♎ ♏ ♐ ♑
Intro ibit Justus, impius exul erit.

Suns entrance into the Signs. The Meaning thus, there are Twelve Words for the Twelve Months, the first *Gaude* for *January*, and so on to *Exit* for *December*. Over every Word stands the Sign appertaining to that Month, as ♈ for *March*, the third Word and Month; then observe with what Letter the Month begins, for if it be a Consonant, then it signifieth the Tenth Day; if with a Vowel, then consider that *a* is the first, *e* the second, and *i* the third Vowel, and to those Words or Months that begin with Vowels, you must add to 10 Days so many Figures as the Vowel intimates; as suppose for *March*, *adest*, here 1 Day must be added to 10, which makes the 11*th* Day of *March* for the Sun to enter into *Aries*, and so for *October*, *impius*, *i* is 3, and ten 13, which is that the Sun enters ♏ the 13*th* of *October*. Again for *February*, *Christus*, because *c* is a Consonant, the Sun enters into ♓ the Tenth of *February*, and for any other Day of the Month, if for every day past the aforesaid day you add one Degree, it will give neer the Degree of the Ecliptick the Sun is in that Day. Example, I desire to know what Degree and Sign the Sun is in the second Day of *June*. First, I seek what Day of *May* the Sun entred into ♊, for so *Aptissimus* intimates, and *a* tells me the Eleventh Day, then I account how many Days betwixt the 11*th* of *May* and the second of *June*, which by considering that *May* hath 31 Days (as before was taught) it will be 22 Days; and therefore the Sun will be in 22 Degrees of ♊. *Suns place.*

Civil Time. Secondly, for the *Civil Time*, which is the Astronomical accomodated to vulgar uses, as from the Sun the *Julian Year* which is either *Common* or *Bissextile*.

Common Year. The *Common Year* contains 365 Days.

Bissextile. The *Bissextile* or *Leap-year* contains 366.

Both

Division. Both these Years are divided into 4 Quarters, *viz.* the *Spring*, *Summer*, *Autumn*, and *Winter*; or into Months, which are 12, before recited; or into Weeks, every one of 7 Days; or into Days, and these are either Festival Days or Working Days.

And because I am now upon the *Civil Accompt* or *Kalender*, I will here, very shortly and plainly, in some few Problems, shew you how to find out the Yeasr, whether Leap-Year or Common, with the Moveable Feasts, Moon's Age, and the like, where I shall borrow from my good Friend, and worthy Astronomer, Mr. *Thomas Street*, his Memorial Verses concerning the Kalender, which will both please and fit my young Scholar for this Matter.

Prop. 1. *To find whether the Year of our Lord be Leap-Year, or the first, second, or third after.*

Rule.

Divide the Year by 4; *what's left shall be*,
For Leap-Year 0, *for past* 1, 2, *or* 3.

Leap-Year. Here you may omit the Hundreds and Twenties of the Year of our Lord, and only divide the Residue by 4. Example, 1678, omitting the Hundreds and Threescore, I divide the Residue 18 by 4, and there remains 2, which is the second after Leap-Year.

Prop. 2. *To find the Golden Number, the Cycle of the Sun, and Indiction.*

Rule.

When 1, 9, 3, *to the Year hath added been*,
Divide by 19, 28, 15.

Golden Number. The *Golden Number* is a certain Figure from 1 to 19, which was so placed in the ancient Kalender, that it might shew the Day of each Month wherein the Moon changed, and being written in Gold got that Name; for the New Moons return to the same Day of the Month every 19 Year.

Cycle of the Sun. The *Cycle of the Sun* is a Number of 28 Years, in which the Dominical Letter returns in a Cycle.

Indiction. The *Indiction* is the Space of 15 Years, which sometimes shewed the Year wherein the *Roman* Tribute was to be paid.

Examples by the former Rule for the Year 1678.

To 1678 adding 1, it makes 1679, which divided by 19, there remains 7 for the *Golden Number*.

To 1678 adding 9, it makes 1687, which divided by 28, there remains 7 for the *Cycle of the Sun*.

To 1678 adding 3, it makes 1681, which divided by 15, there remains 7 for the *Indiction*.

T Prop.

Prop. 3. *To find the Dominical Letter.*

Rule.

Divide the Year, its Fourth, and 4, by 7,
What's left, subtract from 7, the Letter's given.

Dominical Letter. For if you account *A* 1, *B* 2, *C* 3, *D* 4, *E* 5, *F* 6, and *G* 7, the Number found by the Rule will be the Dominical Letter; as for Example; to find the Dominical Letter for the Year 1678. The Fourth of 1678 is 419, and 4 and 419 added to 1678 makes 2101, which divided by 7 leaves 1, and that taken from 7, there remains 6, which is *F*, the Dominical Letter for the Year 1678.

But the Leap-Year hath two Dominical Letters, the latter found by this Rule serveth from St. *Matthias* Day to the Years End, the former (next following in order from *A* to *G*, and beginning again at *A*) serveth from New-Years Day to St. *Matthias*.

Prop. 4. *To find the Epact, the Prime or Golden Number being given.*

Rule.

Divide by 3, for each one left add 10,
30 reject, the Prime makes Epact then.

Epact. Example for the Year 1678, the Golden Number was before found to be 7, which divided by 3 leaves 1, that by the Rule call 10, which added to 7 makes 17, the *Epact* desired.

Prop. 5. *To find the Age of the Moon, or the Day of her Change.*

Rule.

J. F. M. A. M. J. J. A.
Janus 0, 2, 1, 2, 3, 4, 5, 6,
S. O. N. D.
8, 8, 10, 10, *these to the Epact fix,*
The Sum (bate 30) to the Month Day add,
Or take from 30, Age or Change is had.

Age and Change of the Moon. Over every Figure in the Rule, you have the first Letter of the Month in order, as *January*, *February*, *March*, &c. which Figure being added to the Epact, gotten by the foregoing Proposition, the Sum if it be less than 30, or else the Excess above 30, added to the Day of the given Month, (rejecting 30 if need be) gives the Age of the Moon that Day; but subtracted from 30, leaves the Day of the Change in (or from the Beginning of) that Month.

For the Day of the Full Moon, add or subtract 15 to or from the Day of the Change.

Exam-

Example 1. To find the Age of the Moon, May 29, 1678.

The Number for the Month is 3, for you find that Number in the Rule under M. for *May*, which added to the Epact 17 makes 20, and that added to 29 (the Day proposed) makes 49; rejecting 30 there remains 19, which is the Age of the Moon the 29*th* of *May*, 1678.

Example 2. To find the Day of the Change in May, 1678.

The Epact 17 being added to 3 for that Month makes 20, as before, which subtracted from 30, there remains 10, for the Day of the New Moon in *May*, 1678.

Add 15 to 10, and it makes 25, for the Full Moon.

These Rules must be learnt perfectly, for hereafter there will be great use made thereof.

V. The Sum of all that I have said, concerning the Circles of the Sphere or Globes, comes to this:

1. The *Horizon* or *Finitor*, divided into 4 Quarters by the Points of East, West, South, or North, each Quarter into 8 Points, making in all 32 Points, or each Quarter into 90 Degrees, accounted either from East or West towards South or North, or else from South or North towards East or West. The Poles of this Horizon are the Zenith over our Heads, and the Nadir directly under us; and these being 90 Degrees from it, the Circles drawn from Zenith to Nadir by every Degree of the Horizon, are called Vertical Circles; that which passeth by North and South, is likewise the Meridian Line; that by East and West, the Prime Vertical; the rest, Vertical Circles, or Azimuths; and all those parallel to the Horizon, Circles of Altitude, or Almicanters; and the Eighteenth Circle under the Horizon, the *Crepusculum*, or Circle of Twilight. *Horizon.*

2. The *Equinoctial*, or *Equator*, a great Circle divided into 360 Degrees, beginning at the first Point of *Aries*, where the Ecliptick crosseth it, and so numbred round about. The Poles of this Circle are the Poles of the World, the Artick or North Pole elevated to us, and the Antartick or South Pole not seen. The Circles that pass from one Pole to the other, through every Degree of the Equinoctial, are called Meridians or Hour Circles, and the chief is that which passeth by the Zenith, called the Twelve of the Clock or Chief Meridian, and another which passeth in the Middle by Six of the Clock and the Points of East and West, called the Meridian of Six of the Clock. The Circles, which are lesser Circles, and parallel to the Equinoctial, are called the Parallels; those which are 23 Degrees 30 Minutes from it, are called the Two Tropicks, one next the North Pole called the Tropick of *Cancer*, that next the South the Tropick of *Capricorn*; those within 23 Degrees 30 Minutes of each Pole, the Artick and Antartick Circles. *Equinoctial.*

3. The

Ecliptick.

3. The *Ecliptick*, a great Circle divided into 12 Signs, each Sign into 30 Degrees, in all into 360 Degrees. The Poles are in the Artick and Antartick Circles, it crosseth the Equator in the Beginning of ♈ and ♎, and deviateth 23 Degrees 30 Minutes from it, in the Beginning of ♋ and ♑, and maketh an Angle of the same Degrees with it. Those Circles which come from the Poles of the Ecliptick, and pass through each Degree of it, are called Circles of Longitude, one of these is a Meridian, and is called the *Equinoctial Colure*, passing by the Poles of the World and the Beginning of ♈ and ♎: The *Solstitial Colure*, is a Meridian passing by the Beginning of ♋ and ♑.

Equinoctial and Solstitial Colures.

These three Circles, the Horizon, the Equinoctial, and the Ecliptick, with their Circles passing by their Poles, and parallel to them, are all alike, and altering their Position may serve for one another. This being considered and known, I come to the particular Uses, not only of the Globe and Sphere, which I account were invented to help the Fancy, and not for real use, because cumbersome, troublesome, and uncertain; but also of the *Analemma*, and Operation by Scale and Compass, and by Spherical Triangles: And I shall not ramble into an abundance of Propositions, but keep within the Bounds of a very few Triangles, shewing how they are found and posited, both upon the Globe and *Analemma*, and so carrying on this Practice, that what goes before may illustrate and explain what follows. And because Observations are supposed in some things to precede and to be given, I will begin with them, and shew what first is to be gotten, to obtain those which follow.

Section III.

Propositions and Problems particularly concerning the Celestial Spheres.

Problem I.

Of these Three; 1. The Length of a Stile perpendicularly erected upon an Horizontal Plain, 2. The Length of the Shadow upon the Plain, called the Right Shadow, 3. The Altitude or Height of the Sun above the Horizon: Any Two being given, to find out the Third.

It is requisite that the Horizontal Plain be tryed with a Level, and the Perpendicular by a Square, for then this Analogy will perform the Problem, *As* the Length of the Stile, *to* the Length of the Shadow :: *So* is Radius, *to* Co-tangent of the Altitude of the upper Edge of the Sun. These four Parts may be varied so, as to put any of

the Terms into the last Place; which I again propose, that you may be perfect in that necessary Rule; for let the Stile be *st*, the Shadow *sh*, and the Height *ht*, then the former Analogy will be thus,

$$st \,.\, sh :: R \,.\, \text{Co-tang.}\, ht \odot$$
Again,
$$\text{Co-tang.}\, ht \odot \,.\, R :: sh \,.\, st$$
Again,
$$R \,.\, \text{Co-tang.}\, ht \odot :: st \,.\, sh$$
And so of any other.

For the Perpendicular Stile, the Right Shadow, and the Beam proceeding from the upper Edge of the Sun, are the three Sides of a Right-angled Plain Triangle, and the Angle at the Plain is the Angle of the Altitude, the Complement whereof is the Angle at the Top of the Perpendicular; as in Figure 13, CA is the Stile, AB is the Shadow, and CD a Beam proceeding from the upper Edge of the Sun, which make the Right-angled Plain Triangle CAC, wherein the Angle ABC is the Angle of the Sun's Altitude, the Angle C its Complement; and by the former Problems of Right-angled Triangles, you may Resolve it either by Scale and Compass, or by Calculation. Fig. 13.

And here is to be noted, That the End of the Shadow that can be discerned cometh from a Beam that proceedeth from the upper Edge of the Sun, *viz.* the Beam SCB, and not from the Center of the Sun represented by the Line *i*CD, and that because the part of the Shadow BD is not to be discerned, being enligtened by the upper Semidiameter of the Sun *i*S. If therefore you would have the true Altitude of the Sun, that is, of his Center *i*, you must subtract the Semidiameter of the Sun *i*S, or the Angle BCD, (being about 15 Minutes) from the Altitude thus found by the right Shadow, and you will have the true Altitude.

Again, for the same Reason, if you would have the Length of the Stile, or Shadow, you must add 15 Minutes of a Degree to the true Altitude, that you may have the Altitude of the upper Edge of the Sun, which determineth the right Shadow.

And no way differing would it be, if the Stile were fixed upon a Perpendicular or Vertical Plain, the Shadow would then be a Versed Shadow, and the Angle for the Height of the Sun would be the Angle at the Stiles Top.

Problem II.

To take the Height of the Sun or Star by a Quadrant.

You were taught *Chapter II. Section* 4. how to use a Quadrant, whether fixed, or loose in your Hand, and the same I shall not need to repeat now; only, in taking the Height of the Sun, hold the loose Quadrant with its Edge towards the Sun, and move it so, as a Beam of the Sun may shine

Height of the Sun or Star.

ſhine through one Sight upon the other, at a Mark appointed; then if the Thread with the Plummet play eaſily by the Side, ſo as it ſtick not upon the Quadrant, the Thread ſhews the Sun's Height upon the Limb. But if you would take the Height of a Star, or the Moon, then holding the Quadrant up, ſo as the Plummet may play freely, and directing the upper Edge of the Sights upon the Star, the Thread then ſtopt ſhews the Height. This practiſed will ſhew all things eaſily.

This ſame may be done by the Aſtrolabe, which is a whole Circle, after the ſame manner.

Problem III.

To draw a Meridian Line upon an Horizontal Plain.

1. *Way.* Upon any Plain, tried to be Horizontal by a Level, from any Center about the middle, with your Compaſſes deſcribe Arches at convenient diſtances, as you ſee in Figure 14, from the Center A, the Stile is AF, ſet up perpendicularly by the help of a Square; then obſerve in the Forenoon, about 9 of the Clock, when the Shade of the Top of the Stile F ſhall fall in any one of the Circles, as here in the ſecond at B; when this is done, come again about the Hour in the Afternoon that ſhall be equally diſtant from Twelve of the Clock, as ſuppoſe if your firſt Obſervation was about 9 of the Clock, the ſecond will be about 3 in the Afternoon, (or a little before, leſt the time be paſt) and then obſerve when the Shade of the Top of the Stile falls into the ſame Circle as before, as here at C; then, if with yonr Compaſſes you divide the Diſtance B C into Halves at D, the Line A D will be a Meridian Line. *Fig.* 14.

2. *Way.* By taking the Height of the Sun about 9 of the Clock with the Quadrant, and as before having drawn the Line of the Sun's Shadow, made by an upright Stile upon an Horizontal Plain, at length, for now it makes no matter for the Shade of the Top of the Stile; obſerve in the Afternoon, when the Sun comes to the ſame Height, if then you draw out the Shade, the Middle betwixt theſe two Lines is the Meridian Line, as in the laſt Propoſition.

3. *Way.* By the Pole-ſtar, or rather by the Pole it ſelf, and two ſmall Cords, one hung up upon the End of ſome Tree or Beam, and going back, hang the other Cord ſo, as a Line imagined to be drawn by them by the Eye would paſs into the Pole, then are thoſe two Lines in the Meridian. You were taught before in the firſt Section of this Chapter, how to find the very Point in the Heavens where the Pole is.

4. *Way.* The Diſtance from the Pole-ſtar to the Pole, is now 2 Degrees and 25 Minutes, and the Pole lies in a direct Line betwixt the Pole-ſtar and *Alioth*; if therefore you cut but off from the Pole-ſtar in that Line 2 Degrees and 30 Minutes, which you may do many ways, you may thereby ſet off a Meridian Line, as before in the third Way.

Problem

Problem IV.

To get the Height of the Pole.

1. *Way.* If either by the Pole-ſtar, or any other Star which never ſets, but is always in ſight, you take with your Quadrant its higheſt Altitude above the Pole, and its loweſt under, theſe two Heights added together, the Half thereof will be the Height of the Pole above the Horizon, allowing for Retraction, as you ſhall preſently be taught.

2. *Way.* When *Alioth*, or the Thill-Horſe of *Charles's Wain* in the *Great Bear*, comes into the Meridian under the Pole, take the Height of the Pole-ſtar, and out of that Height ſubtract the Diſtance of the Pole-ſtar from the Pole, which is now 2° 25′, the Remainder will be the Height of the Pole.

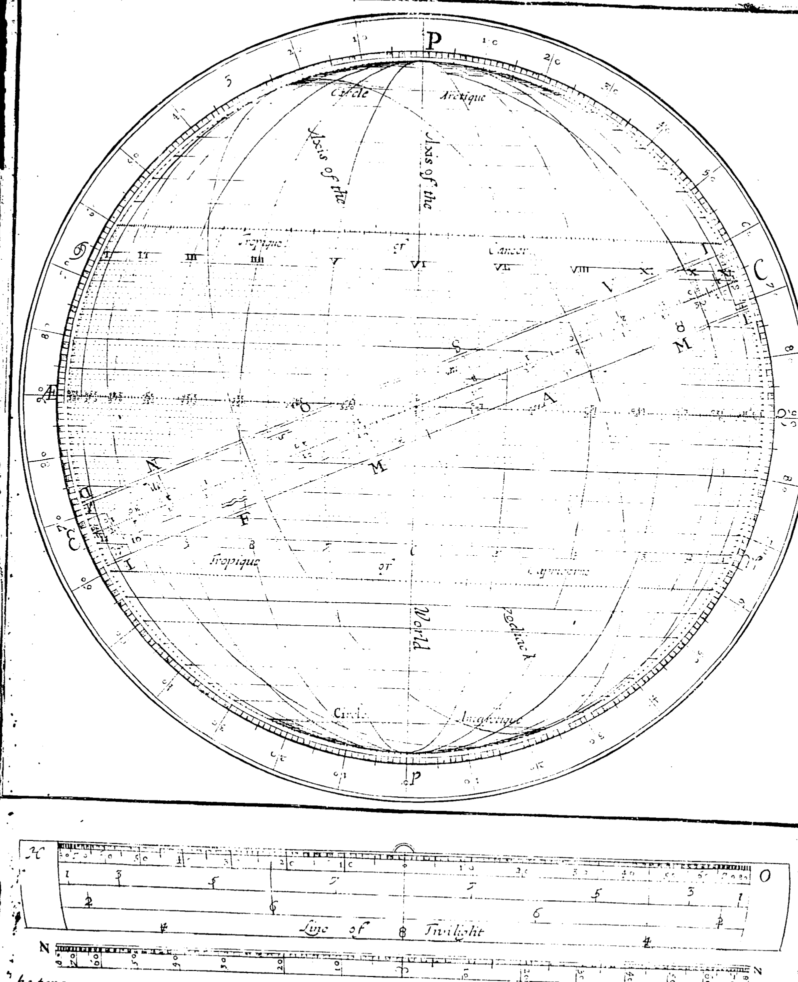
Problem V.

To find by Obſervation, the Diſtance of the Tropicks, the greateſt Declination of the Sun, and the Altitude, or Elevation of the Pole above the Horizon.

Take the Altitude of the Sun above the Horizon, juſt at high Noon, when he is the neareſt to us in the Summer Solſtice, in the Tropick of *Cancer*, (which is on the Eleventh of *June*,) and alſo when he is in the Winter Solſtice, or Tropick of *Capricorn*, (which is upon the Eleventh of *December*;) then ſubtract the leſſer of theſe Altitudes from the greater, and the Remainder is the Diſtance of the Tropicks, half of this Remainder is the greateſt Declination of the Sun, which being ſubtracted from the greater Altitude, or added to the leſſer, either way, there will be left the Height of the Equinoctial, the Complement of which is the Altitude or Elevation of the Pole above the Horizon. When the Globe is rectified, and ſet to the Elevation of the Pole here at *London*, which is found by Obſervation to be 51 Degrees 30 Minutes, if you ſhall ſtand upon the Eaſt part of it, and imagin every part of it to be preſſed down upon the Plain of the Meridian perpendicularly, then will it form that Projection called the *Analemma*, all the Meridians will be *Ellipſes*, except the Meridian of Twelve, which is the outmoſt Circle, and is the Plain whereon it is drawn, and the Solſtitial Colure; and the Meridian of Six of the Clock, which is a ſtraight Line, and repreſents the Equinoctial Colure: And I would have the Youths to be ſet to draw this Projection, and be ſhewn how it repreſents the Globe; as for Example in Figure 15; upon any Paper and bigneſs, as you pleaſe, draw a Circle, which let it repreſent the Braſs Meridian in the Globe, then by the Center draw a Diameter HO, which let repreſent the Horizon, the Center ♈ will be the Point of Eaſt and Weſt upon the Horizon, H will be *Analemma.* *Fig.* 15.

be the South Point, and O the North. Now for *London*, where the Pole is Elevated 51° 30′, if you have a Line of Chords, or a Circle divided, of that Radius, (which you have been fully instructed how to do) take from it 51° 30′, and set it from O to P the North Pole, draw P ♈ *p* for the Six of the Clock Hour-Line, it is the Equinoctial Colure, and *p* is the South Pole, then take 90 Degrees from your Circle or Chord-Line, and set it from H or O to Z and N, and from P to Æ or Q, so shall Z be the Zenith, N the Nadir, or the two Poles of the Horizon, and Z ♈ N is the Prime Vertical Circle, or the Azimuth of East and West; from the Point Æ, which is 90 Degrees from the Poles, draw Æ Q for the Equinoctial Circle, Æ on the Meridian above the Horizon, and Q below; then, because by the best Observations the greatest Declination of the Sun is found to be 23° 30′, take those from the Circle divided, and prick it off from Æ to E, and from Q to C, and draw E ♈ C for the Ecliptick, the Center ♈ will be the Equinoctial Point, and the Place of ♈ and ♎ in the Ecliptick, E will be the Point of ♋, and C of ♑; then from E draw E♋, parallel to Æ Q the Equinoctial, it will be the Tropick of *Cancer*, and draw from C another Parallel, it will be C♑ the Tropick of *Capricorn*. The Poles of the Ecliptick will be 23 Degrees 30 Minutes from the Poles of the World, at *n* and *m*. And so much for this Figure at this time, which if moderately understood will conduce much to the Knowledge and Practice of the Globe or Sphere; for it will explain the last Proposition very exactly; for supposing the greatest Meridian Height of the Sun the Eleventh of *June* was H E, the least the Eleventh of *December* H ♑, now if I take H ♑ from H E, it will leave ♑ E the Distance of the Tropicks, and half of that will be Æ E or Æ ♑ the greatest Declination of the Sun, and forms the Angle that the Equinoctial makes with the Ecliptick Æ ♈ E, which is found to be 23° 30′, and constantly so; now the second part of the Problem bids you to take the half of the Distance of the Tropicks equal to Æ E from the greater Height H E, or add it to the lesser Height H ♑, it shall give the Height of the Equinoctial H Æ, which is very plain from the Figure; lastly, that this Equinoctial Height is equal to the Complement of the Poles Height is thus cleered, P Q is equal to 90 Degrees, P O is the Poles Height, which taken from P Q, leaves O Q its Complement. But O Q is equal to H Æ, (because the Head Angle O ♈ Q is equal to the Angle Æ ♈ H,) but H Æ is the Height of the Equinoctial, and therefore the Complement of the Height of the Pole. Lastly, observe what I said before, that the greatest Obliquity of the Ecliptick, or the greatest Declination of the Sun is found by diligent observation to be 23° 30′, equal to the Angle Æ ♈ E, or Q ♈ C, and that the Poles Height at *London* is 51° 30′.

Problem



between page 144 and 145 Cosmog

Problem VI.

Of these Three; 1. the Meridian Altitude of the Sun or Star, 2. the Elevation of the Pole, and 3. the Declination of the Sun or Star; any Two being given, to find the Third.

IF the Meridian Altitude be to be taken in the South Quadrant of the Meridian Line ZH, then,

1. Altitude of the Equinoctial, less the Meridian Height, is equal to the Declination South.

2. Meridian Altitude, less the Altitude of the Equinoctial, is equal to the Declination North.

But if the Meridian Altitude be in the North Quadrant of the Meridian Line ZO, then,

1. Poles Elevation, less by the Meridian Altitude, is equal to the Complement of the Declination North.

2. Meridian Altitude, less by the Poles Elevation, is equal to the Complement of the Declination North.

Problem VII.

Of these Five; 1. the greatest Declination of the Sun, 2. the Longitude of the Sun from the next Equinoctial Point, 3. the Right Ascension of the Sun from the same Equinoctial Point, 4. the Declination of the Sun in that Place, and 5. the Angle that the Ecliptick makes with the Meridian; any Two being given, to find out the rest.

THis Proposition brings me to the Use of the Globe or Sphere, and to the Use of the *Analemma*, whether by Scale and Compass, or by the Projection which I have fitted for Use, and likewise to the Practice of Spherical Triangles; for when the Work is thus carried on, it will give more knowledge, and make the Scholar more perfect. I will therefore explain the Business first upon the Globe.

1. The Globe fixed only in the Meridian, without any consideration had to the Horizon at all, performs this Problem, and therefore needs not rectifying.

2. The *Analemma*, made on purpose, and fitted on Pastboard, where the Horizon HO is fixed fast, and the Meridian, with the Equinoctial, its Parallels and Hour-Lines, with the Ecliptick, move about the Center, and are to be rectified and raised for the Elevation of the Pole, even as the Globe, and is very easie to be understood, which is all I aim at. For the making and drawing of it, if you know how to divide the Diameters, and

which I fhewed you in the Doctrine of *Plain Triangles*, according to a Line of Sines, as thefe are done, there is no further difficulty but in the Ellipfes, which will not now be material to teach you.

3. By Scale and Compafs, the Work is declared before in the Fifth Problem, and fhall be explained again as need requires.

4. By Spherical Triangles, the Doctrine is already delivered in the Fourth Chapter, and thereto reference fhall be made.

The Terms of this Problem are thus explained:

1. The greateft Declination of the Sun is 23 Degrees 30 Minutes, and the prefent Declination of the Sun, or any Star, is how many Degrees and Minutes they lye from the Equinoctial, and that is known by the Parallel that paffeth by them.

2. The Longitude of the Sun, or of any Point of the Ecliptick, from the next Equinoctial Point, is the Diftance therefrom in Degrees and Minutes. The Sun's Longitude tells in what part of the 12 Signs he then is, fuppofe in 4° and 40′ of *Taurus*; but to fit all for Calculation, it is required to know how far we are from the Beginning of *Aries* and *Libra*, as in the former Example, the 4° 40′ of *Taurus* is 34° 40′ from the Beginning of *Aries*, for the Sign *Aries* is 30°, which added to 4° 40′ of *Taurus*, makes the aforefaid Longitude. Therefore in the firft Quarter of the Ecliptick, (*Aries*, *Taurus*, and *Gemini*,) turning the Signs into Degrees, it is without alteration; in the fecond Quarter, (*Cancer*, *Leo*, and *Virgo*) turn the Signs into Degrees from *Aries*, and fubtract them from 180, it leaves you the Diftance from the Equinoctial Point of *Libra*. The like is to be obferved in the other two Quarters, to find the Longitude fought from the two Points of *Aries* and *Libra*.

3. The Right Afcenfion of the Sun, or Star, is that Arch of the Equinoctial, contained betwixt the Beginning of *Aries*, and the Point of the Equinoctial that comes to the Meridian with the Sun or Star. And this is the Regulator of all the uneven Motions upon the Pole of the Ecliptick. But when the Right Afcenfion is found always lefs than 90°, and that is accounted from the next Equinoctial Point, you muft obferve,

The Right Afcenfion of the Sun from the next Equinoctial Point,	In the firft Quadrant, without alteration, In the fecond Quadrant, being fubtracted from 180°, In the third Quadrant, being added to 180°, In the fourth Quadrant, being fubtracted from 360°,	Is the true Right Afcenfion from the Beginning of *Aries*.

Note alfo, That the whole Right Afcenfion, or 360°, or Part, is required often to be turned into Time, and fo fometimes the Time to be turned into Degrees and Minutes. To do this, you muft reckon for every 15 Degrees 1 Hour, every Degree 4 Minutes of Time, and every Minute 4 Seconds,

Seconds, and contrarily; fo that if you divide the whole Degrees by 15, it gives the Hours, and the Remainder as before will give the Minutes; and contrarily, multiply the Hours by 15, and the Minutes by 4, &c. it gives the Degrees. However in the third Book you have Tables to do the fame. Thefe Hours and Minutes of the Right Afcenfion, fhew the Time, how long the Sun, or any Point, cometh to the Mid-heaven, or the South Part of the Meridian Line, after the Beginning of *Aries*.

Having cleared the Terms, we come to the Refolving the Problem.

1. *By the Globe.*

Sun's Place in the Edge of the Horizon.

This Problem, refpecting only the Ecliptick and Equator, may be performed by the Globe and Meridian only. Suppofe then, for an Example, that on *April* 14, 1678. at Noon, it be demanded to give the Sun's Place, his Declination and Right Afcenfion; firft, upon the Horizon of the Globe (where there is a Kalender for the Sun's Place anfwering the Days of the Month) I feek for the 14 of *April*, and juft againft it I find 4 Degrees and about 30′ of *Taurus*, for the Sun's Place that Day in the Ecliptick, he having moved and crept along, as I familiarly inftanced before, from the Firft of *Aries*, where he was the Tenth of *March* before, to the Fourth Degree of *Taurus*, that is near a Degree of the Ecliptick in a Day, fo that in about 34 Days the Sun's Longitude will be from *Aries* 34° 30′. Then I come to the Globe, and in the Ecliptick feek for 4½° of *Taurus*, and bring it to the Meridian, and telling the Degrees upon the Meridian (under the fiducial Edge, or that divided) betwixt the Ecliptick and Equinoctial, I find them 13 Degrees and fomething more, and that is the Declination; and at the fame time find what Point of the Equinoctial the faid Meridian cuts, which is 32 Degrees and almoft an half, for the Sun's Right Afcenfion. Laftly, I confider how all this comes to pafs, and find out the Spherical Triangle, which is made by the Ecliptick, from the Beginning of *Aries* to the 4° 30′ of *Taurus*, for one fide; by the Equinoctial, from the faid Point to the Meridian, for another fide; and by that Part of the Brafs Meridian, contained betwixt the Ecliptick and Equinoctial, for the third fide. And in this Triangle are the Five Parts of the Problem contained, *viz.* B C the Longitude of the Sun, B A his Right Afcenfion, C A the Declination, the Angle at B 23° 30′ the greateft Declination, which is always the fame, and the Angle at C 70° 15′, which we fhall not here meddle withall. You muft note, That any Two of thofe Five Parts will find the Three remaining by the Globe; for by the Sun's Longitude or prefent Declination you might find the Right Afcenfion and greateft Declination, or by the Right Afcenfion and Declination, or any two, the reft might be found, by bringing the Parts to the Meridian, and working as before. And there might be 16 feveral Varieties thereof.

April 14. the Sun's Place in 4 deg. 30 m. of Taurus.

Sun's Longitude.

Sun's Declination.

Sun's Right Afcenfion.

Fig. 16.

2. *By the Analemma, or Instrument.*

If you seek the Day of the Month on the Out-lines of the Zodiack, there will be answering in the Ecliptick Line (that is in the midst of the Zodiack the Sun's Place) 4 Degrees 30 Minutes of *Taurus*, which is distant 34° 30′ from the Beginning of *Aries*. Mark the Meridian that comes from the Pole P, and falls upon that Point, or imagin one, and you will find it cuts the Equator in 32° 15′ for the Right Ascension; then tell the Parallels from the Equinoctial to the Sun's, and you will find that which passeth through the Sun's Place to be 13 and a little more, which is the Declination; and there you may find the aforesaid Spherical Triangle, from the Center, or *Aries*, to those Places; and by any Two of the Five Parts in the Problem you may find the rest.

Sun's Place and Longitude. *Right Ascension.* *Declination.*

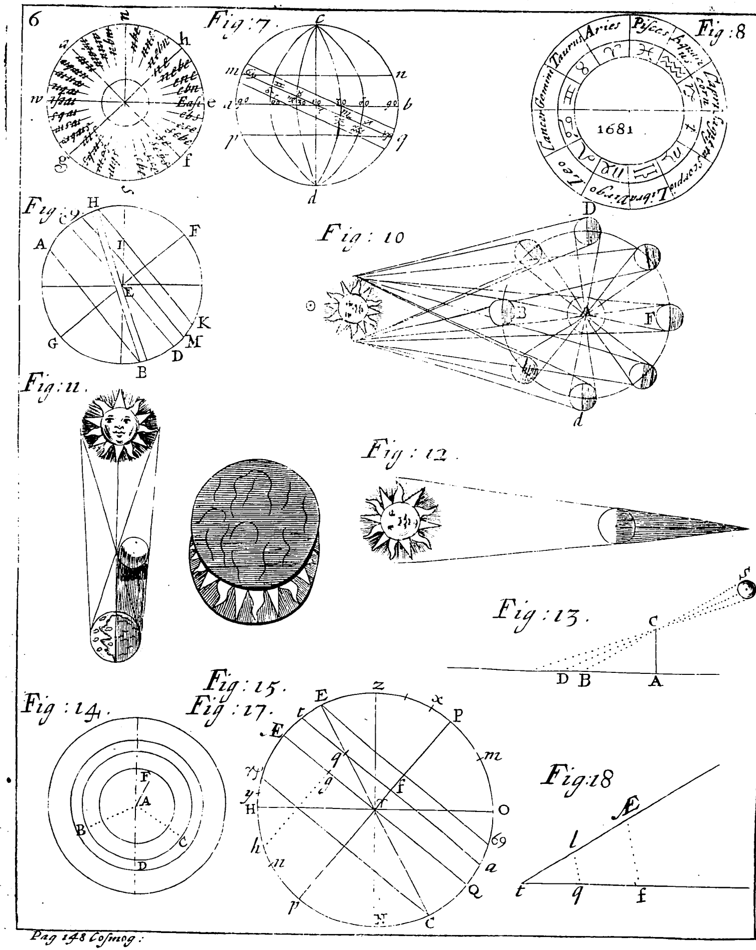
3. *By Scale and Compass.*

Fig. 17. By the Line of Chords, or a Circle divided, as you did in Figure 15 so note in this Figure 17, draw the Out-circle for the Meridian, and draw the Equinoctial and Ecliptick, and mark their Poles, then by the *Latin* Verses, or by your Almanack, or some such way, you may find the Sun's Place to be 4 Degrees 30 Minutes of *Taurus*, that is 34 Degrees 30 Minutes from the *Fig. 18.* Beginning of *Aries*. From *m* and *n*, the Poles of E C, set off 34° 30′ either way to *x* and *y*; lay a Ruler to *x* and *y*, and crossing E C at *q*, there is the Sun's Place. By *q* draw a Parallel to the Ecliptick *f a*, and you will find Æ *t* or Q *a* the Declination to be 13° and something more; and if you divide the Radius of the Equinoctial Æ♈, like as the Radius of the Parallel *ft* is already divided, thus, draw a Line at length, in which set off *t f* equal to *f t*, and *t q* equal to *t q*, make what Angle you please, as *f t* Æ, set off *t* Æ for the Radius of the Equinoctial, and draw *f* Æ and *q l* parallel, set *t l* from the Center ♈ to *q*, raise a Perpendicular from *q* to the Equinoctial, the Distance from that Point *h* to the Pole P is the Degrees answering to the Right Ascension 32 Degrees 15 Minutes. All which may be varied to any Two of the given Parts in the Problem to find the rest.

4. *By Calculation.*

The Spherical Triangle on the Globe A B C, or in the Instrument *r q l*, is Right-angled at A or *l* by the Meridian falling on the Equator, the Hypothenuse B C is the Longitude 34° 40′, (found in an *Ephemeris* of the Sun,) the Angle at B is the greatest Declination 23° 30′, always constant; B A is the Right Ascension, and C A the present Declination.

Now if the Right Ascension be sought,



There is given the Hypothenuse BC 34° 40′, and the Angle at B 23° 30′; To find the Side B A.

If you remember, it is the second Proposition and second Variety of *Right-angled Spherical Triangles*, by the Hypothenuse and Angle adjoyning to find the Side adjoyning to that Angle. And the Rule is,

As Co-sine B . Radius :: Co-tangent B C . Co-tangent B A

That is, if you add the Logarithm of the Co-tangent B C to the Radius, and subtract the Co-sine of B, it will leave you the Co-tangent of B A.

Calculation of the Right Ascension.

Radius	10,000000
Co-tangent B C 34° 40′	10,160162
Co-sine B 23° 30′	9,962398
Co-tangent B A 32° 23′	10,197764

Thus the Right Ascension will be found to be 32° 23′, and if you will take the pains, a Table of Right Ascensions may after this manner be Calculated; but this is done to your hands for every Degree of Longitude.

To find the Declination of 34° 40′ of Longitude,

There is given the Hypothenuse BC, and the Angle adjoyning B; To find the side opposite to the Angle given C A.

By the aforesaid second Proposition of *Right-angled Triangles* and the first Variety, the Rule is,

As Radius . Sine B C :: Sine B . Sine C A

That is, add the Sine B C to the Sine B, and take away the Radius, and it gives the Sine of C A.

Declination.

Sine B C 34° 40′	9,754960
Sine B 23° 30′	9,600699
Sine of C A 13° 07′	19,355659

Thus you find the Declination to be 13° 07′; and after this manner the Table of Declinations in the second Book was made.

And in the Right-angled Triangle B A C, any Two Parts of the Problem will find Three more, and make 16 Varieties; all which were the Examples in the 6 Propositions of *Right-angled Triangles*, and 16 Cases, where you will find them all wrought, to which I refer you. And what has been said of the Sun, is explicable of the Stars.

Problem

Problem VIII.

Of these Three; 1. the Right Ascension of the Sun, 2. the Hour of the Day, and 3. the Right Ascension of Mid-heaven; any Two being given, to find out the Third.

I Shewed you before, how the Equinoctial might be either divided into Degrees, as it is upon the Globe, or else (being that is the Measure of Time) into Hours, Quarters, and Minutes, every 15 Degrees being an Hour, and so the whole into 24 Hours, for 15 times 24 is 360 Degrees. Therefore first know, that if you add the Sun's Right Ascension in Time, to the Time from Noon, the Sum will be the Right Ascension of Mid-heaven, or the Right Ascension of the Point of the Ecliptick, that at that very Point of Time is in the Meridian. But if it be required to have the Right Ascension of Mid-heaven in Degrees and Minutes, then turn the Time from Noon into Degrees and Minutes, by multiplying the Time by 15, as before was shewed, and it gives your desire. Example of the 14*th* of *April*, 1678, at Half an Hour past 4 in the Afternoon: The Time past Noon is 4 Hours and an half, which is 67° 30′, for 4 times 15 is 60, and the half of 15 is $7\frac{1}{2}$, in all 67° 30′. The Right Ascension of the Sun before was found to be 32° 23′, that is, 2 Hours, 9 Minutes, and 32 Seconds, for 30 Degrees is twice 15°, which is 2 Hours, and 2 Degrees is 8′ of Time, and 23 Minutes is 92″ of Time, that is 1′ 32″, in all 2 Hours, 9′, 32″; so that the Right Ascension of Mid-heaven is 6 Hours, 39′, and 32″, and in Degrees 99° 53′.

Now to find the Hour of the Day by the Right Ascension of the Sun, and the Right Ascension of Mid-heaven, if you subtract the former from the latter, it gives the Answer in Degrees, or in Time, as you please.

If you would know the Right Ascension of any Star, then observe diligently, by some exact Clock, Watch, or Hour-Glass, the Time betwixt the Star's coming to the Meridian at South, after the Sun, that is, at what Time after High-Noon the Star cometh to the Mid-heaven, for the Right Ascension of Mid-heaven at that time is also the Right Ascension of that Star that is in the Mid-heaven; therefore the Right Ascension of the Sun, more by the Time of the Star's Southing, is equal to the Right Ascension of the Star.

Problem

Problem IX.

Of these Five; 1. the Elevation of the Pole, 2. the Declination of the Sun or Star that may Rise or Set, 3. the Amplitude Ortive or Occasive of the Sun or Star, 4. the Ascensional Difference of the Sun or Star, and 5. the Angle at the Sun or Star, shewing the Position thereof, in respect of the Pole of the World, and the North Part of the Horizon; any Two being given, to find any one of the rest.

First I shall explain the Terms not formerly mentioned, that is, the *Amplitude Ortive*, which is the Degrees and Minutes of the Horizon, contained betwixt the Point of East and the Point of the Horizon where the Sun or Star riseth, or if you will go by the Mariners Accompt, the Point of the Sea-Compass, or one of the 32, where they Rise. Or if the *Amplitude Occasive* be required, it is the same on the West side from the Point of West. *Amplitude Ortive.* *Occasive.*

The *Ascensional Difference*, is the Time, or Degrees and Minutes of the Equinoctial, that is contained betwixt the Hour of Six, either Morning or Evening, and the Time of the Sun or Star's Rising or Setting. *Ascensional Difference.*

The *Angle* at the Sun or Star, is what Angle the Meridian makes there with the Horizon.

1. *By the Globe.*

Let the Example be the 14*th* of *April*, 1678. the Sun's Place 4 Degrees and 40 Minutes of *Taurus*.

This Problem compares the Equinoctial, its Parallels and Meridians, with the bare Horizon; therefore if the Sun's Place be given, the Declination is 13° 7′, and the Poles Height at *London* 51° 30′ as before. Now therefore I must rectifie my Globe, first to the Latitude, by lifting the Meridian up or down, so that there may be 51° 30′ betwixt the North Pole and the Horizon, (which always must be observed to be done in that or any other Latitude,) if the Horizon or its Circles be in the Question. And secondly, it must be rectified, as to the Sun, by altering the Hand of the little Hour-Wheel fixed upon the Meridian about the Pole, which by bringing the Sun or Star to the right Edge of the Meridian, and then turning the Hand to 12 of the Clock at Noon, which is that 12 farthest from the Horizon. This is done, because that no other Point is so certain, and that when the Sun comes under the Meridian it is 12 of the Clock. Therefore bring the Sun's Place to the Horizon, (by turning the Globe about) and there hold him, the Index upon the Hour-Circle shews the Ascensional Difference, that is, how many Hours and Minutes before or after 6 of the Clock the Sun riseth; and accounting how many Degrees and Parts is contained betwixt *Rectifying the Globe.* *The Index.* *Ascensional Difference.*

Amplitude Ortive. twixt the Point of East and the Sun upon the Horizon, that Number is the Amplitude Ortive; as in our Example, the Ascensional Difference is 17 Degrees o Minutes, or 1 Hour 8 Minutes, and the Amplitude Ortive 21 Degrees 15 Minutes from the East towards the North. And the same Amplitude will be at the West that Day for Occasive. Occasive.

This being performed, you may observe the Triangle upon the Globe that forms this Resolution, that is, Part of the Meridian from the Pole to the Horizon 51° 30′, Part of a Meridian imagined to be drawn from the Pole by the Index, and so to the Sun's Place at the Horizon, which is the Complement of the Sun's Declination 76° 53′, and laid down in Figure 19. Fig. 19. You must note likewise, That any Two of the Five being given, you may by the Globe find the rest: As for Example, by the Amplitude 21° 15′, and the Ascensional Difference 17 Degrees, or 1 Hour 8 Minutes, to find the Latitude. Mark the Amplitude in the Horizon from East towards the North, then having rectified the Globe, as to the Sun's Place, to that Amplitude, bring the Sun (keeping the Hour Index at 1 Hour and 8 Minutes before 6) by lifting the Globe up and down, 'till he rises just at that Amplitude, then you may find the Elevation of the Pole; and the rest may be done thus very easily.

2. *By the Analemma.*

Here this Instrument must be rectified, by turning the North Pole P to the Height above the Horizon, at *London* 51 Degrees 30 Minutes, and then finding the Sun's Place, and its Parallel, follow the Parallel to the Horizon, and there you will find the Amplitude 21° 15′, and the Difference from 6 1 Hour 8 Minutes as before, and all things as plain as in the Globe.

3. *By Scale and Compass.*

Fig. 20. Describe the *Analemma* as was shewed before, and describe the Sun's parallel as before, mark where it cuts the Horizon H O, as at *r*, if from *r* you raise a Parallel to ♈ Z, you will find the Arch Z *k* to be the Amplitude 21° 15′, and if you cut the Equinoctial in proportion as the Parallel is cut by the Horizon, and raise a Parallel to ♈ P, and it will give you the Ascensional Difference 17°, or 1 Hour 8 Minutes.

4. *By Calculation.*

Fig. 20. In the *Analemma*, or in the last Scheme, if you mark the Spherical Right-angled Triangle P O *r*, you will find it to agree with that formerly observed on the Globe, where P O is the Poles Height, *r* O the Complement of the Amplitude, and P *r* the Complement of the Sun's Declination, the Angle at P is the Complement of the Ascensional Difference, the Angle P *r* O is the Angle the Meridian makes with the Horizon. Now to Calculate this Triangle, where the Five Parts of the Problem are to be found, and

any two being given, you may find the rest, by the 6 Propositions of Right-angled Spherical Triangles, and the 16 Varieties.

Example.

There is given, 1. the Declination of the Sun 13° 7′, and his Complement 76° 53′ for r P; *and 2. the Height of the Pole* P O 51° 30′; *To find* 1. r O, *the Complement of the Amplitude; and 2. the Angle at* P.

For the first, by the Hypothenuse *r* P, and a Side P O, to find *r* O, marked as in Figure 19 with A B C, the Rule by the first Proposition and second Variety will be, Fig. 19.

As Co-sine C A . Co-sine B C :: Radius . Co-sine B A

Co-sine C A 51° 30′	9,794149
Co-sine B C 76° 53′	9,355901
Radius	10,000000
Co-sine B A 68° 37′	9,561752

Whose Complement 21° 23′ is the Amplitude Ortive.

Here working the Question as was done in the last, the Side *r* O is found, and its Complement will be ♈ *r* the Amplitude.

Again, with the same *Data* to find the Ascensional Difference, or the Angle *r* P O, which is its Complement, that is, by the Hypothenuse, and a Side, to find the Angle at P. The Rule, by the first Proposition and third Variety, is,

As Tangent B C . Tangent C A :: Radius . Co-sine C

Tangent B C 76° 53′	10,632618
Tangent C A 51° 30′	10,099395
Radius	10,000000
Co-sine C 72° 58′	9,466777

Thus I find the Angle at P 72° 58′, its Complement 17° 2′, or 1 Hour 8′ 8′, for the Ascensional Difference.

After this manner, and after the 6 Propositions and 16 Varieties before taught, you may vary all the Five Parts of the Problem, and with any Two find the other Three, which I advise the Learner to do. And what has been said of the Sun, is applicable to any Star that Setteth and Riseth. And note, for the Not-setting or Not-rising of certain Stars, That,

1. If the Elevation of the North Pole be greater than the Complement

X of

of the North Declination of the Star, then that Star Setteth not: But if it be greater than the Complement of the South Declination of the Star, then that Star Riseth not.

2. If the Elevation of the South Pole be greater than the Complement of the South Declination of the Star, then that Star Setteth not: But if it be greater than the Complement of the North Declination of the Star, then that Star Riseth not.

Fig. 20. Lastly, note in the Figures, and likewise in the Globe, That there is another Right-angled Triangle under the Horizon ♈ *r s*, that being resolved, will perform this Problem as the former; it is made up of Parts of three Great Circles, *viz.*

Of these Five,
1. *r s* the Declination of the Sun,
2. ♈ *s* the Ascensional Difference,
3. ♈ *r* the Amplitude Ortive,
4. The Angle *s* ♈ *r* the Complement of the Poles Elevation,
5. The Angle ♈ *r s*,

Any Two being given, to find out any One of the rest.

And this Triangle being marked with A B C, A representing the Right Angle, which here is ♈ *s r*, may be resolved sixteen various ways, and will bring forth the same Resolutions of this last Problem, as before was declared; and may be wrought by Scale and Compass, as before.

Problem X.

The Declination, the Right Ascension, and the Difference of Ascension, of the Sun or Star, being given; To find the Oblique Ascension and Descension of the Sun or Star.

1. IF the *Elevation of the Pole* and *Declination* be both either North or South, subtract from the *Right Ascension* the *Difference of Ascension*, and there will be the *Oblique Ascension*; or, add to the *Right Ascension* the *Difference of Ascension*, and there will be the *Oblique Descension.*

2. If the *Elevation of the Pole* and *Declination* be one North and the other South, add to the *Right Ascension* the *Difference of Ascension*, and there will come the *Oblique Ascension*; or, subtract from the *Right Ascension* the *Difference of Ascension*, and there will come the *Oblique Descension.*

Problem

Problem XI.

To find the Semidiurnal Arch of the Sun, or any Star that Riseth and Setteth, and when it Riseth and Setteth.

1. IF the *Elevation* of the Pole and *Declination* of the Sun or Star be both of a kind, that is to say, if they be both North, or both South, then the *Difference* of Ascension being converted into Hours and Parts, and added to 6 Hours, there will be produced the *Semidiurnal Arch.*

2. But if the *Elevation* of the Pole and *Declination* of the Sun or Star be not both of a kind, but the one be North and the other South, then the *Difference* of Ascension, being converted into Hours and Parts, and subtracted from 6 Hours, the Remainder will be the *Semidiurnal Arch.*

The Semidiurnal Arch is half the Time that the Sun or Star moveth above the Horizon: And therefore,

1. If it be subtracted from the Time of the Sun or Star's coming to the South, the Remainder will be the Time of the Rising of the Sun or Star.

2. But if it be added to the Time of the Sun or Star's coming to South, the Sum will be the Time of the Setting of the Sun or Star, casting away 12 if need be.

3. If the Semidiurnal Arch be doubled, it sheweth the whole Continuance of the Sun or Star above the Horizon.

Problem XII.

Of these Six; 1. the Elevation of the Pole, 2. the Declination of the Sun or Star, 3. the Altitude of the Sun or Star above the Horizon, 4. the Distance of the Sun or Star from the Meridian in Degrees or Hours, 5. the Azimuth of the Sun or Star from the North, and 6. the Angle at the Sun or Star: Any Three of them being given, to find out any One of the rest.

THis Problem is resolved, by comparing the Equinoctial, its Meridians, and Parallels, with the Horizon, and its Vertical Circles called *Azimuths*, and its Parallels called *Almicanters*; and it being chiefly employed to find the Hour of the Day and Azimuth, is of great Use both in Astronomy and Navigation.

1. *By the Globe.*

Let the Example be the 14*th* of *April*, 1678, the Sun being in 4 Degrees and 40 Minutes of *Taurus*, and its Declination 13 Degrees 7 Minutes, the Poles Height 51 Degrees 30 Minutes, and the Sun's Height 30 Degrees above the Horizon.

X 2 First:

Globe rectified in the Hour-Circle and Index. First, the Globe must be rectified, that is, the Hour-Circle, by bringing the Sun to the true Edge of the Meridian, and setting the Hour-Index to 12 of the Clock of the Day, that Index supplying the Place of Meridians, which in the Projection of the Globe cannot be, and therefore are expressed. *In the Height of the Pole.* Secondly, it must be rectified to the Height of the Pole. And thirdly, the Quadrant of Altitude, which is a thin Plate of Brass divided into 90 Degrees, equal to 90 Degrees of the Equator, Ecliptick or Horizon, and must be fixed by a Skrew to the Zenith, which must be as far from the Equinoctial as the Elevation of the Pole comes to; or if you tell from the Pole P towards the Equinoctial, the Complement of the Poles Height that way *In the Quadrant of Altitude to the Zenith.* will find the Zenith, for betwixt the Zenith and the Horizon is 90 Degrees, and taking out of 90° the Poles Height, it leaves the Complement for the Zenith; as for Example, 38° 30′ is the Complement of 51° 30′, the Height of the Pole at *London*, which being told from the Pole towards the Equinoctial, there fix the Skrew, for that is the Zenith, and the Center or Middle of the Pin that the Quadrant of Altitude turns upon must be sure to be directly under the divided Part of the Meridian; and observe, that in turning the Quadrant about, the lowest Division thereof agree with the Edge of the Horizon, and so round about.

Having thus fitted the Globe, you must move the Sun's Place and this Quadrant up and down, and in such manner, as that the Sun's Place, *viz.* 4° 40′ of *Taurus*, may exactly meet with 30 Degrees of the Quadrant of Altitude, which after some attempts you may do: And then,

1. The Index upon the Hour Circle shews it to be 8 Hours and half a Quarter before Noon, the true Time of the Day.

2. The Quadrant of Altitude, by his true Edge, betwixt the Globe and the Horizon, shews the Azimuth to be 72° 15′ from the South, or from the East, if you please, 17° 45′.

Observe, That the Brass Meridian describes and supplies all the Parallels or Distances from the Equinoctial, and the Hour-Circle and Meridian supplies all the Meridian or Hour-Circles.

Azimuth. The Azimuth is the Distance of any Vertical Circle from South or North, or from East or West, as you please to accompt.

Lastly note, That the Triangle made upon the Globe for this Resolution, is thus, from the Zenith to the Pole is one Side, which is the Complement of the Latitude; from the Zenith upon the Quadrant of Altitude to the Sun's Place is another, which is the Complement of the Sun's Height; and from the Sun's Place to the Pole, by an Imaginary Meridian Line, supplied by the Index and Hour Circle, another Side, and is the Complement of the Declination; the Angle made at the Pole, by the Brass Meridian and the Imaginary Hour-Circle passing to the Sun, is the Degrees from Noon, which turned into Hours is the Time from Noon; the Angle made at the Zenith, by the Brass Meridian and Quadrant of Altitude, is the Azimuth from the North Part of the Meridian; there is another Angle made by the Quadrant of Altitude and Hour-Circle, which makes the six Parts of the aforesaid Problem.

2. By

2. *By the Analemma.*

This is to be rectified to the Pole's Height, by bringing the North Pole P 51° 30′ above the Horizon (here at *London*) and there let it rest; next find out the Sun's Place in the Ecliptick, and its Parallel: And well considering that Parallel, you may observe in it, at what Hour the Sun Riseth, the Amplitude and Height of the Sun or any Star or Point being limited by the Parallels to the Horizon, as you may see them expressed, (which by a Silk Thred laid over all equally on both sides from the Horizon, shews the Almicanter.) If you lay a Thred over the Point of 6 of the Clock Parallel, as aforesaid, it shews the Height of the Sun at 6 of the Clock in Summer. And yet further tracing the Parallel 'till the Sun come into the Prime Vertical, there among the Hour-lines you may find the Time of the Day: As in our Example, crossing a Thred over 30 and 30, in that Height you shall find it cut the Parallel a Quarter past 8 of the Clock in the Morning. And so when the Sun or Star shall pass to 12 of the Clock or Mid-day, then you must trace him back again along the same Parallel 'till he descend to the Horizon, noting, that then you must account by the Afternoon-Hours, *viz.* 1 for 11, 2 for 12, 3 for 9, *&c.*

3. *By the Scale and Compass.*

In Figure 20 draw a Line gi, 30 Degrees on either side from H and O, where that crosseth the Sun's Parallel, as at q, there is the Sun's Place at that Height; and if you cut ♈ Æ proportionally as the Parallel tf is cut at q, and raise a Perpendicular at k, the Degrees cut in the Circle is the true Time from 6, *viz.* 2 Hours 15 Minutes, or 37′; and so of the rest. *Fig.* 20.

4. *By Calculation.*

In the Figure you will find the Oblique-angled Triangle Z P q; that Z P, as I shewed before, is the Complement of the Height of the Pole 38° 30′, Z q the Complement of the Sun's Height 60°, and P q the Complement of the Declination of the Sun 76° 53′: All these are given to find the Angle at P, which is the Sun's Distance from the Meridian in Degrees, and the Hours in Time. By the second Problem of *Oblique-angled Spherical Triangles*, you will find the Rule and Example thus: *Fig.* 20.

Deg.

		Deg.	Min.		
Compl. of the Pole's Height	ZP	38	30	Arith.Sine	0,205850
Compl. of the Declination	Pq	76	53	Arith.Sine	0,011481
Difference		38	23		
Complem. of the Sun's Height		60	00		
Sum		98	23		
Difference		21	37		
The Half Sum		49	11	Sine	9,878984
The Half Difference		10	48	Sine	9,272726
Sum of all the four Sines					19,369041
Half Sum will be					9,684520

Which is the Sine of 28° 56′, which doubled will be 57° 12′, and that converted into Time is 3 Hours 51 Minutes, that which the Sun wants of 12 or 8 of the Clock and 9 Minutes that Day.

Ex. 2. Having the same things given, to find the Azimuth, *viz.* the Angle contained betwixt the Meridian and Vertical Circle; that is, having ZP as before 38° 30′, and Z*q* the Complement of the Sun's Height 60°, including the Angle fought, and the Base P*q* the Complement of the Declination 76° 53′; to find the Azimuth from the North, *viz.* PZ*q*.

	Deg.	Min.		
Complem. of the Pole's Height	38	30	Arith.Sine	0,205850
Complem. of Sun's Height	60	00	Arith.Sine	0,062469
Diff. of the last	21	30		
Compl. Declin.	76	35		
The Sum	98	23		
The Difference	55	23		
The Half Sum	49	11	Sine	9,878984
The Half Diff.	27	47	Sine	9,667075
Sum of all the four Sines				19,814368
The Half Sum				9,907184

Which is the Sine of 53° 52′, and that being doubled comes to 107° 44′, the Azimuth from the North; and taken from 180°, leaves 72° 16′, the Azimuth from the South; and subtract 90° from it, leaves the Azimuth from the East, 17° 44′.

There are many ways for resolving this Problem, but this last way is most easie in my apprehension; however, 'till the young Practicioner be expert, it is good to try two ways, *viz.* if they agree you may assure the Work: Therefore I will give you this following Example for the same.

Deg.

	Deg.	Min.		
Base ZS	60	00		
The Side PS	76	53		
The Side ZP	38	30		
Sum	175	23		
Half Sum	87	41	Arith.Sine	0,000355
Diff. of Base and Half Sum	27	41	Arith.Sine	0,332934
Difference of Sides	10	48	Sine	9,272725
	49	11	Sine	9,878984
The Sum of all four				19,484998
The Half Sum				9,742499

	Deg.	Min.		
Base PS	76	53		
The Side ZS	60	00		
The Side ZP	38	30		
Sum	175	23		
Half Sum	87	41	Arith.Sine	0,000355
Diff. of Base and Half Sum	10	48	Arith.Sine	0,727274
Diff. of 2 Sides and Half Sum	27	41	Sine	9,667065
	49	11	Sine	9,878984
The Sum of all four				20,273678
The Half Sum				10,136839

Now these two found Numbers 9,742499 and 10,136839 are no Sines, as in the former Operations, but Tangents, and give for Degrees and Minutes in the first 28° 56′, in the second 53° 52′, which being doubled makes 57° 42′ the Distance from the South, and 17° 44′ for the Azimuth from the East; and being the same that was found the first way, confirms the Operation, and are to be applied as before.

This Problem may be varied many ways.

First, For resolving this Spherical Triangle, by having all the Sides given, to find the rest.

1. Given { The Com. of the Pole's Height ZP; The Compl. of Sun's Declinat. P*q*; The Compl. of the Sun's Height Z*q* } to find { The Hour < P; The Azim. < Z; The Angle *q* }

This Case is wrought before two several ways, and is the second of the four Cases in the Analysis of *Oblique-angled Spherical Triangles*, to be wrought by the second Problem thereof.

Secondly, Having two Sides and an Angle opposite, or two Angles and a Side opposite, to find the rest.

1 Given

	Given	To find	or, Given	To find	or, Given	To find
1.	ZP	Z	ZP	Z	Pq	ZP
	Zq	P	Pq	P	Zq	P
	q	Pq	q	Zq	Z	q

	Given	To find	or, Given	To find	or, Given	To find
2.	Z	ZP	Z	Pq	P	Zq
	P	Pq	q	Zq	q	Pq
	Zq	q	ZP	P	ZP	Z

All these Varieties, being the first Case of the *Analysis* of *Oblique-angled Triangles*, are performed by the first Problem thereof.

Thirdly, Having two Sides and the Angle comprehended given, to find the rest.

	Given	To find	or, Given	To find	or, Given	To find
1.	ZP	Pq	ZP	Zq	Zq	ZP
	Zq	P	Pq	Z	Pq	P
	Z	q	P	q	q	Z

These Varieties, being the third Case of the *Analysis*, are performed by the sixth and seventh Problems of *Oblique-angled Spherical Triangles*.

Fourthly, Having two Angles and a Side adjacent, or two Sides and an Angle adjacent, to find the rest.

	Given	To find	or, Given	To find	or, Given	To find
1.	Z	ZP	Z	Zq	P	ZP
	P	Zq	q	Pq	q	Pq
	Pq	q	ZP	P	Zq	Z

	Given	To find	or, Given	To find	or, Given	To find
2.	ZP	P	ZP	Pq	Pq	ZP
	Pq	q	Zq	Z	Zq	P
	Z	Zq	q	P	Z	q

These Varieties, being the fourth Case of the *Analysis*, are resolved by the fourth and fifth Problems of *Oblique-angled Triangles*: All which I leave to the Practicioner, there being 60 Varieties in this one Triangle.

1. Note, That if the Point at *q* be the Sun (as before was in the Example) then the Angle ZP*q*, or the Distance of the Sun from the Meridian, is the Time either before High-noon, if the Sun be in the Eastern part of the World, *viz.* moving from the North part of the Meridian towards the South part thereof: Or else it is the Time after Noon, if the Sun be in the Western part of the World, *viz.* moving from the South part of the Meridian towards the North part thereof.

2. But if the Point at *q* be a Star, then the Angle at P, or Distance from the Meridian, is what that Star wants of 12 in the Eastern part, or what past 12 in the Western.

3. Note here, That sometimes the Hour of Six is named, and of the Elevation of the Pole, &c. in the Problem belonging to the Sun, some are required from others given; in which Case the Triangle is right-angled at

at the Pole, as in the Triangle (*Fig.* 20.) ZP*t* right-angled at P, (for the Hour Lines of 12 and 6 are cut at right Angles) and therefore particularly for the Hour of Six this Problem may be thus expressed, *viz.* *Fig.* 20.

Of these Five,
1. The Elevation of the Pole,
2. Declination of the Sun,
3. The Sun's Height at 6 of the Clock,
4. The Azimuth at 6 of the Clock,
5. The Angle at the Sun,

Any Five being given, to find any One of the rest.

Because in the Triangle ZP*t* Right-angled at P, the Side P*t* being the Hour Line of 6 of the Clock:

1. PZ is the Complement of the Elevation of the Pole.
2. P*t* is the Complement of the Declination.
3. Z*t* is the Complement of the Sun's Height at the Hour of 6.
4. *t*ZP is the Azimuth of the Sun from the North at 6.
5. P*t*Z is the Angle at the Sun, shewing the Position thereof, in respect of the Pole and Zenith, at 6 of the Clock.

And therefore by the 16 Cases and 16 Varieties of *Right-angled Spherical Triangles*, any one of these may be found out by any two given, and the Radius.

4. Sometimes again the Azimuth of East or West is named, and of the Elevation of the Pole, and the rest in the Problem, some are required from others given; in which case the Triangle is Right-angled at Z, as the the Right-angled Triangle PZ*s*; and particularly for the Azimuth of East or West, this Problem may be thus expressed:

Of these Five,
1. The Elevation of the Pole,
2. The Declination of the Sun or Star,
3. The Sun or Star's Altitude in the East or West Azimuth,
4. The Distance of the Sun or Star from the Meridian, when it is in the East or West,
5. The Angle at the Sun or Star,

Any Two being given, to find any One of the rest.

Because in the Triangle P*s*Z Right-angled at Z, the Side Z*s* being the Azimuth of East and West: *Fig.* 20.

1. PZ, is the Complement of the Elevation of the Pole.
2. P*s*, is the Complement of the Declination of the Sun or Star.
3. Z*s*, is the Complement of the Altitude of the Sun or Star, being full East or West.
4. The Angle at P, is the Distance of the Sun or Star (being in the East or West Azimuth) from the South Part of the Meridian.
5. The Angle at S, is the Angle at the Sun or Star, shewing the Position thereof in respect of the Pole and Zenith, when it is in the Azimuth of East and West.

And therefore by the Problems of the Calculation of the Right-angled Spherical Triangles, any one of these may be found out, by any two given.

Lastly, There are many other Triangles and Problems to be considered upon the Globe and Projections, which I reserve for the Last Part, these being sufficient at this time, and for this purpose.

Problem XIII.

Of the Uses of the Eight Maps of the Fixed Stars, in their Prints, annexed at the End of this Chapter.

I. THere be six of the Planispheres all equal in bigness, from whence follows, 1. That all make one Cube; 2. That the Sphere, which is so reduced, may be imagined a Cube; 3. That they touch the Sphere only in six Points, *viz.* the two Poles, the two Equinoctial Points, and other two Points in the Equinoctial answering the Solstices.

II. The Rays or Lines of the Projection are drawn from the Center of the Sphere, from whence foll ows, 1. An easie way to find the Right Ascension and Declination of the Stars; 2. That the Great Circles are always straight Lines.

III. There are only 45 Degrees projected in each Table from the Center, from whence it comes, that the Figure of each Constellation scarce exceeds its due Magnitude.

IV. The Tables are placed in this order, the first, that about the Artick Pole, as most known; the last, that about the Antartick, always hid to this Latitude; the rest follow the Order of the Signs.

The Contrivance of these six Maps, made by Father *Pardie* at *Paris*, affords, that the Stars may be more easily found by them than by the Globes or Spheres, for that in the Globe the Stars are set on the convex Superficies, but in the Heavens, and these Maps, *in Plano*, as to apprehension; for placing one Eye at the Distance of the Semidiameter of the Chart, and perpendicularly on the Center, and holding the Map in a right Position, if the Stars on the Map were perforated, the Eye would see all the Stars of the Heavens answering thereto through the Holes. This premised, the Uses follow.

1. *By the Maps, to find the Stars in the Heavens.*

First, turning towards the North, find out the notorious seven Stars of the *Great Bear* called *Charles's Wain*, four whereof (fancied to be the Wain) make a Quadrilateral Figure, and the other three a scalenous Triangle, which are the Horses, that next the Wain is called *Alioth*. Having found these, consider what Figure they make with other Stars: As for Example: Draw a Right Line by the two farthest of the Wain from the Horses, and it will direct you to the Pole-star in the Tip of the *Little Bear*'s Tail, distant from the Pole it self in this Year, 1678, 2 Degrees 25 Minutes, and from the Pole-

Pole-star you will find the seven Stars of the *Little Bear* almost in the same Site and Position with the former of the *Great Bear*. Now the *Dragon* lies wreathed betwixt these two Constellations of the *Bears*, as you may see by the Maps: Now to find first the greatest Star in the *Dragon*, conceive a Line drawn from the Middle Horse of *Charles's Wain* to another Star of the Third Magnitude which the *Little Bear* has in his Right Shoulder; this Line passeth by a Star of the Second Magnitude in the *Dragon*. This being found, ascend to the other three of the Third Magnitude, and so to the rest in that Constellation. And thus by observing the Position of the Stars in the Maps, either as they lye in Quadrangles, Triangles, or straight Lines, those known with the unknown, all the Stars of one Chart may be found in one Night.

2. *To find the Distance of any two Stars.*

This being the Parts of an Arch of a Great Circle, passing through the two Stars, if both of them be found in any of the Circles divided, as in the Equator, Ecliptick, or Colures, then the Distance it self is found by the Degrees intercepted. But if the two Stars, whose Distance is required, be found in any Right Line that passeth by the Center of the Chart, or near unto it, take the Distance from the Center to one of them, and measure it from the Center on any of the Divided Lines, and set that Number of Degrees down by it self, do the same Work for the other, the Sum of those two Numbers is the Distance required. The third way, to find the Distance of any two Stars, generally not posited as abovesaid, is shewed in the sixth Section following.

3. *To find the Right Ascension and Declination of any Star in the Charts.*

First for the Right Ascension, if the Star be found in the two Polar Charts, lay a Ruler to the Center or Pole by the Star, and where it cuts the Limb you will find the Right Ascension in Degrees and Parts. But if the Star be found in some of the other four Charts, it either falls in some Meridian, which followed to the Equinoctial, shews the Right Ascension; or else betwixt two Meridians, which by a Ruler, parallel to a Meridian, shews the same, as before. Example: In the first Map or Polar Chart, the Right Ascension of *Alioth* will be found 190 Degrees; of *Arcturus*, in the fourth Map, the Right Ascension will be 210 Degrees and a little more.

The Declination (being the Distance of a Star from the Equinoctial) is found by the Circle of Declination that passeth by it, or estimated betwixt two, which are Parallels to it; as in the first Map, or Polar Chart, the first Horse in *Charles's Wain* is 51 Degrees of Declination North; the Declination of the Bright Star in *Andromeda*'s Head, in the second Map, is 27 Degrees 30 Minutes North; and the *Great Dog-star*, in the third Map, is found to be 16 Degrees of Declination South.

Note, That the Right Ascension and Declination of the Stars are computed for the Year 1680, and may serve without Error for many Years after.

4. *By the Charts, to trace out the Way of a Comet, when seen.*

First, find out the Place or Point in the Maps where the Comet first appears, thus; Take Four Stars, whereof Two one way and Two another, that pass in a Right Line with the *Comet*, draw these Lines in the Chart, and the Crossing of them will point out the Place of the *Comet*: Do this for another Observation or two: A streight Line drawn by these Two or more Places, describes the Way of the *Comet* for its future Appearance, according to the best Theories of *Comets*.

5. *To find by the Charts what Stars do perpetually appear, and what are always hid.*

Knowing the Height of the Pole, as at *London* 51° 30′, all the Stars that lye between the Pole and the Parallel that is distant from the Equinoctial above 38° 30′ the Complement of the Pole's Height, always appear; and on the contrary from the South Pole, disappear. And so for any other Latitude.

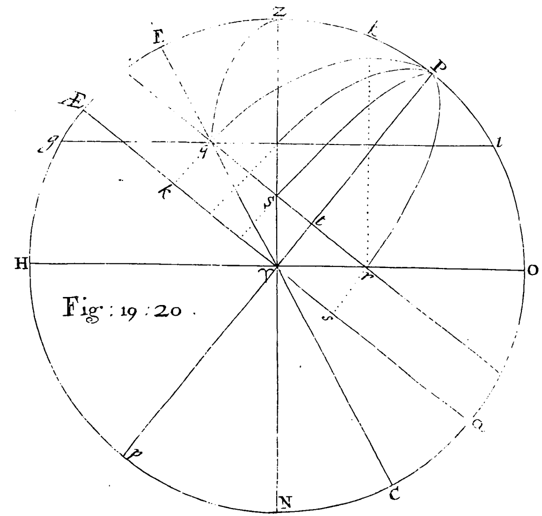
For the Longitude and Latitude of the Stars, though Father *Pardie* hath drawn them in his great Maps, yet I have omitted them here, for fear of the confusion too many Lines might cause.

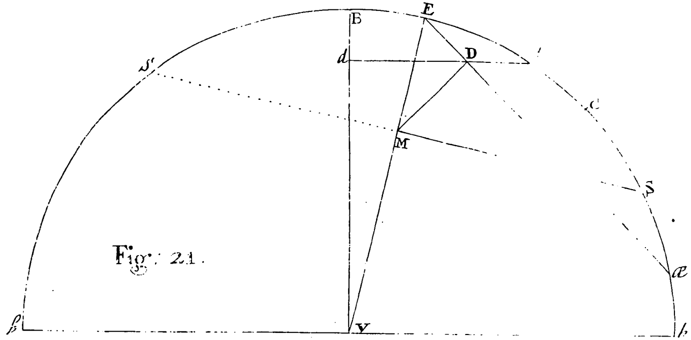
6. *To find the Distance of any two Stars upon the 6 Charts.*

This distance is part of a great Circle which passeth betwixt the Stars proposed, and therefore if the two Stars fall under one and the same Meridian, the Difference of Declination will shew the Distance; but if otherwise, then you must work this Geometrical Problem, *viz. Having the Right Ascension and Declination of any two Stars given, To find the Distance.* Which is performed several ways by the Projection of the Sphere; but I find it most easily solved by Mr. *Thomas Baker*, Minister of *Bishop-Nympton* in *Devonshire*, my worthy Friend, amongst his resolutions of all Spherical Triangles, whether Right or Oblique, Geometrically; which he was pleased to impart to me, and it is the third Problem of Oblique Spherical Triangles, *viz. By the two Sides of any Spherical Triangle, and the Angle included, to find the third Side.* Which is performed after this manner.

For Example.

Let the bright Star in *Cassiopeia*'s Chair, of the third Magnitude, in the first Polar Map be proposed, whose Right Ascension is 357° 59′, and Declination North 57° 25′. And the bright Star in the Swans Tail, of the third Magnitude, whose Right Ascension is 307° 37′, and Declination North





Pag 165 Cosmog

North 44° 10'. Now to form the Triangle at the Pole, take the Differences of the Right Ascensions, by subtracting the less from the greater, *viz.* 357° 59', less by 307° 37', rests 50° 22', for the Angle at the Pole; and take the Complements of the Declinations, *viz.* of 57° 25' and 44° 10', gives 32° 35' and 45° 50', for the two Sides of the Triangle proposed; *Fig.* 21.
which done, divide a Circle into two Quadrants *V b B β*, set *B* to the top, Point, and let *V* be the Center, measure *B C* an Arch equal to one Side 45° 50', (and this do by dividing the Circle into Parts, or from a Line of Chords) and *C E* and *C æ* equal to the other side 32° 35', draw the Lines *E æ*, and make *E S* equal to the Angle given 50° 22', draw the Radius *V E*, and from *S* let fall the Perpendicular upon it *S M*, and from *M* upon *E æ* let fall the Perpendicular *M D*, and by *D* draw the Line *d D d* Parallel to the Diameter *b V β*. Then is the Arch *B d* 33° ½ the Side sought, and the Distance of the two Stars in *Cassiopeia's* Chair and the Swans Tail. This Problem is very easie to work, and will be of great use, as well for the finding the Distance of the Stars, as the Distance of two places upon the Terrestrial Globe, and the Operation will find the same Distance from the Longitude and Latitude of the same Stars, *viz.* that in *Cassiopeia*, the Longitude 00° 38' of ♉, and Latitude North 51° 17'; that in the Swan, Longitude 00° 58' in ♓, Latitude North 59° 57'. If you take the Complements of the Latitudes 38° 43', and 30° 3', they will be the Sides of the Triangle, and the Angle will be the Difference of the Longitudes of the two Stars, *viz.* 59° 40', the Distance will be found 32° ½.

And because the Solution of the Oblique-angled Spherical Triangle is of such great use, *viz. Where the two Sides and an Angle included are given, to find the third Side.* I will work the Problem by *Artificial Sines and Tangents*, according to the sixth Problem of *Oblique-Angled Spherical-Triangles*, taught before, pag. 116, *viz.* BC, B, *and* BD *being given, to find* DC: By the second Analogy, (1) *As* Radius . Co-tang. *BA* :: Co-sine *B* . Tang. *BA*. Compare *B D*, the Side whereupon the Perpendicular falleth, with *BA*, and you will find *BD*. Then say,

As Co-sine *BA* . Co-sine *DA* :: Co-sine *BC* . Co-sine *DC*.

As Radius	————————	10,000000
To tang. of BC	32° 35'	9,805580
So Co-si. of B	50° 22'	9,804733
To tang. of BA	22° 11'	19,610313
BD	45° 50'	
DA	23° 39'	

As

As Co-si. BA 22° 11′	9,966601
To Co-si. DA 23° 39′	9,961901
So Co-si. BC 32° 35′	9,925626
	~~1~~9,887527
To Co-si. DC 33° 32′	9,920926

First, to find the Distance of the former two Stars, by their Difference of Right Ascension 50° 22′, for the Angle *B*, and the Side BD 45° 50′, and BC 32° 35′; according to the Rule work as in the Example, and you will find BA 22° 11′, which taken from BD 45° 50′, leaves DA 23° 39′. Then working the second time, and you shall find the third Side sought to be 33° 32′, for the Distance of the said two Stars.

As Radius ————————	10,000000
To Tang. BC 38 43′	9,903973
So Co-si. 59° 40′	9,703317
To Tang. of BA 22° 2′	~~1~~9,607290
BD 30° 3′	
DA 08° 1′	

As Co-si. BA 22° 02′	9,967063
To Co-si. DA 8° 1′	9,995735
So Co-si. BC 38° 43′	9,892233
	~~1~~9,887968
To Co-si. DC 33° 32″	9,920905

The like Operation and Distance will be found from the Longitude and Latitude of the said Stars, their Difference of Longitude being 59° 40′ for the Angle B, the Complements of Latitude 38° 43′, and 30° 3′, for BD and BC, the Operation will be as you find in the Example; and the third Side will be found 33° 32′, for the Distance of the two Stars.

Thus both Geometrically, and by Calculation, the Distances of any two Stars may be found, with this Caution only, That if the Angle given be Obtuse, or above 90°, then take its Complement to 180°, and instead of the Side found, take its Complement likewise.

7. To

7. *To use the said Six Charts of the Stars for the finding, or learning to know the Stars in the Heavens by Observation, and are so many Astroscopes when thus used.*

According as the Radius for these six Charts is greater or lesser, so must the Instrument be made accordingly. I will begin with the two Polar Charts, that of the North Pole, and that of the South Pole. The Radius of these small Charts is 4 Inches, if you make a Nocturnal, which shall have an Axis 4 Inches from the Plane of the Chart, and whereupon the Chart must be pasted, with a Cavity through it to look upon the North, and finding at any time which of the Stars in the Chart are in the Meridian, and set the Chart accordingly, then will all the Constellations near the Pole be visible, and may be easily learnt; and the time of the Night may be known, by comparing the Right Ascension of the Sun, with that of the Star.

The same may be practised by the Chart of the Southern Pole, after the same manner.

But for the four other Charts, they must be placed at Right-Angles to the Equinoctial or Parallel to the *Axis* of the World. Therefore if you prepare an Instrument so fixed upon an Horizontal Plane, that it may have a Pin of a sufficient length, elevated to an Angle, equal to the Latitude of the Place where it is to be used; and that it may be turned so, that the *Axis* may lie in, or over the Meridian Line; then let any of the four Plates be fixed upon this *Axis*, so that they may be four Inches from this *Axis*, and turn round about it. For use, turn this Chart round about, 'till you see it agree with any of the Stars thereupon; so will you see all the rest in their places, and may thereby know all, or any of the Stars that are in the Charts.

8. *Of the strange (and wonderful, 'till the Invention of Prospect-Glasses) Appearances of the Stars, some new, some ancient, and of the Planets in these latter Ages.*

I. In the Appearance and Disappearance of several Stars that have no Parallax visible, and have and now do alter their bigness, and some are not found to return any more.

1. The first that was notable, was that in *Cassiopeia*, *Anno* 1572. observed by the famous *Tycho Brahe*, which from the fourth, increased to as big as any of the first, and bigger, and after some Months grew less, and disappeared.

2. That in the Swan's Breast, observed by *Kepler*, and by *Hevelius*, from 1658 to 1670, many times appearing and disappearing.

3, 4. In 1638, one new Star appeared in the Whales Mouth, and this Star in the same place was observed by *Bullialdus* many times, and by Monsieur *Hevelius*, and another in the Whales Neck.

5. One

5. One in *Anno* 1665, observed in the Girdle of *Andromeda* by *Bullialdus*, and formerly by *Marius*, 1614; other new Stars have appeared in the Swan, observed by Monsieur *Hevelius*; and some likewise in the Swan by Monsieur *Cassini*, and many others in *Orion*, and other Constellations, as may be found in the Relations of *Ricciolus*, and several other persons.

II. In the strange Discovery that the Telescopes have made in the Planets:

1. *Saturn* appearing Tricorporeal to *Galileus* first, and since their alteration, that sometimes those two Bodies about him seem one Line, and Monsieur *Cassini* has discovered two small Stars move with him, like our Moon.
2. *Jupiter* with four Moons or Stars moving about him, as his own Body turning about shewed by a spot upon *Jupiter*.
3. *Mars* turns about, and upon his *Axis*, as *Jupiter*.
4. *Venus* horned, full, and in the Wane, as our Moon.
5. The spots and shadows in the Sun, and the turning of his whole Body about it.
6. The spots and strange Extuberances in the Moon, and the Fibration of her Body.

These I say are admirable and worthy of *Ovid*'s Verse:

Felices animæ, quibus hæc cognoscere primum,
Inque Domos superas scandere cura fuit.

SECTION IV.

Of the Plain SCALE.

To make the Lines of Chords, Natural Signs, Tangents, Secants, Semitangents, Rumbs, Hours and M. Longitude, which are on the Plain Scale.

Describe a Circle as ADEF, and Quarter it with the two Diameters AE, DF, at Right-angles one the other.

1. Divide the Arch DE into nine equal parts, and setting one foot of the Compasses in E transfer the divisions of the Arch marked 10, 20, &c. to the strait Line ED: so is ED a *Line of Chords* for every 10 degrees, the single degrees may be divided by judgment.

2. Through the Division 10, 20, &c. draw parallels to CD, which will divide CE into a *Line of Signs*.

3. On E raise EG perpendicular to CE, and laying a Ruler over C and the Points 10, 20, 30, &c. draw the Lines 10. 10; 20, 20; 30, 30, &c. so is EG a *Line of Tangents*.

4. Setting one foot on C, extend the other to the several degrees, of the *Tangent Line* EG and describe the Arches 10, 10, 20, 20, 30, 30, &c. which makes the Line CDH a *Line of Secants*.

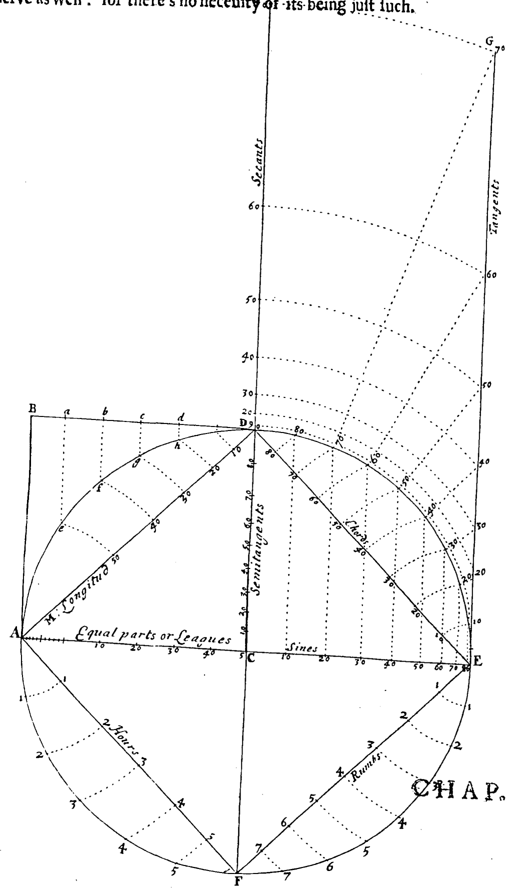
5. Laying a Ruler over A and the degrees 10, 20, 30, &c. of the Arch ED, make marks on the Line CD, which becomes a *Line of Semitangents*.

6. Divide the Arch EF into eight equal parts, and setting one foot of the Compasses in E with the other transfer the Divisions of the Arch 1, 2, 3, &c. to the strait line, which Line EF so divided is called a *Line of Rumbs*.

7. Divide the Arch FA into six equal parts, and setting one foot in A, transfer them to the strait line FA which becomes a *Line of Hours*. This serves only for the dividing a Circle readily into twenty four equal Parts.

8. Make the square ACDB, and divide its sides AC, BD into six equal Parts, drawing the lines *a e*, *b f*, *c g*, &c. parallel to AB; then setting one foot in A with the other transfer the marks *e*, *f*, *g*, &c. to the strait line AD, which line so divided is called the line of *Miles long*.

9. A C ferves for a line of equal parts to take off Leagues, or Miles, &c. from. Though indeed any other line of equal Parts would ferve as well: for there's no neceffity of its being juft fuch.



CHAP.

CHAP. VI.

Of NAVIGATION.

SECTION I.

DEFINITIONS.

NAvigation Teacheth and Demonſtrateth, how a ſufficient Ship may be conducted the ſhorteſt way, and in the ſhorteſt time between any places aſſigned in Paſſages Navigable.

If the places aſſigned be at no great Diſtance, but ſo that a Ship may Sail in ſight of Land, or within Soundings between them, then it's called a *Coaſting*.

The Diviſion of Navigation according to the Voyage.
Coaſting.

For the performance of which there's required good knowledg of the Lands, the uſe of the Compaſs, and Lead or *Sounding Line*, ſuch are the Voyages on the Narrow, or *Britiſh* Seas between *England*, *Holland*, and *France*, alſo all about the *Baltick* Seas, and indeed thoſe in the *Mediterranean* are little other.

Sometimes I had thoughts of inſerting here a Rutter, with all the helps that might be for Coaſters: but conſidering that every Sea Chart has the Depths, Bearing, and Diſtances, and what they are wanting in, the *Waggoners* indifferently will ſupply, I have omitted it.

If the Voyage be to be performed in a Vaſt Ocean, where all that's viſible for many days, nay weeks together is *nil niſi Pontus & Æther*, then it may be called *Navigation Proper*; and requires not only the Lead-Line and ordinary Compaſs, but Azimuth Compaſs, Charts, and Log-board, with inſtruments for Celeſtial Obſervations, as the Quadrant, Foreſtaff, *&c.* and the Navigator muſt be able by theſe to find at any time in what Place the Ship is, which is done by comparing it with any known Place, that is, how far the ſame known Place is ſituate from the Ship, either towards the North or South, which is called the Difference of Latitude, or towards the Eaſt or Weſt, which if in proper Degrees is called the Difference of Longitude.

Navigation Proper.

To

To find which Place of the Ship, how far she hath sailed, and consequently how far she hath to Sail, and which way, or upon what Course, *&c.* there are these things given or at most times to be attained: the Latitudes both of the Place wherein the Ship is, and whence she set Sail, as also that of the Place she's intended for. Secondly, Her Course, which is given by the Compass; and Thirdly, the account of the Ships way, attained by the Log. How to state and order these things given, to produce those required, shall in the Next Chapter be shewed.

Latitude. *Latitude* is the Distance of a Ship or Place from the Equinoctial either North or South, and is counted on the Meridian.

And note that if a Ship Sail towards the Equinoctial, she's said to Depress the Pole, but if she Sail from the Equinoctial or from a lesser Latitude to a greater she's said to Raise the Pole.

Longitude. *Longitude* is the Distance of a ship, or Place East or West from another counted in proper Degrees: but if in Leagues or Miles or Degrees of the Meridian, and not in those proper to the Parallel of Latitude, it's commonly called *Departure*, *Separation*, *Easting* or *Westing*, &c.

Course. The *Course* is that point of the Compass, or Coast of the Horizon on which the Ship is to be steered from Place to Place; or rather the ∠ between the Rumb-line and the Meridian.

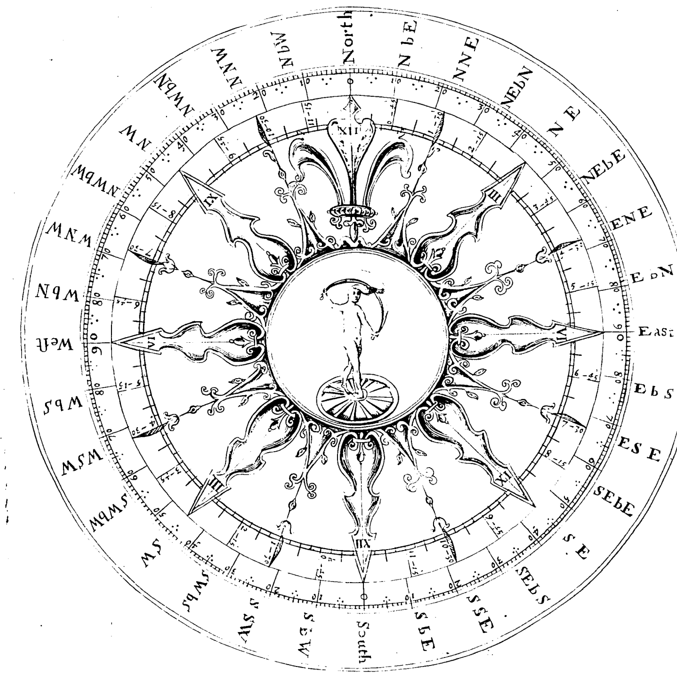
Rumb. *A Rumb* is one Point of the Compass or $11°\frac{1}{4}$, *viz.* the $\frac{1}{32}$ Part of the Circumference of the Horizon or Compass Card, which is the Representative of the Horizon.

A *Rumb line* is a Line described by the Ships motion on the surface of the Sea, steered by the Compass, making the same or equal ∠s with every Meridian.

The Rumb I take to be the same with the Course, *viz.* the ∠ between the *Rumb-line* and Meridian, only the one is a *Portuguese*, and the other an *English* word.

The

The Compass Card with its Rumbs, or Points.



The

The Distance of the Rumbs, or Points from the Meridian.

North	*South*	D.	M.	*South*	*North*	*Point.*
		2	49			
		5	38			
		8	26			
N by *E*	*S* by *E*	11	15	*S* by *W*	*N* by *W*	1
		14	4			
		16	53			
		19	41			
N N E	*S S E*	22	30	*S S W*	*N N W*	2
		25	19			
		28	8			
		30	36			
N E b *N*	*S E* by *S*	33	45	*S W* by *S*	*N W* b *N*	3
		36	34			
		39	23			
		42	11			
N E	*S E*	45	00	*S W*	*N W*	4
		41	49			
		50	37			
		53	16			
N E b *E*	*S E* by *E*	56	15	*S W* b *W*	*N W* b *W*	5
		59	4			
		61	52			
		64	41			
E N E	*E S E*	67	30	*W S W*	*W N W*	6
		70	19			
		73	07			
		75	56			
E by *N*	*E* by *S*	78	45	*W* by *S*	*W* by *N*	7
		81	34			
		84	22			
East		87	11	*West.*		
		90	00			

The

Sailing according to the Rumb, is either Right or Oblique.

NAvigation or Sailing in respect of the *Rumb*, or *Point* Sailed on is aptly divided into *Right* and *Oblique*.

Right Sailing.

Right Sailing is, when the Voyage is performed on some one of the four *Cardinal Points*.

If a Ship Sail under a Meridian, that is, on the North or South Points, she varieth not the Longitude at all: but only changeth the Latitude, and that just so much as the number of Degrees she has Run.

If a Ship Sail under the Equinoctial upon the very East or West Points, she altereth not her Latitude at all: but only changeth the Longitude, and that just so much as the number of Degrees she hath Run.

If a Ship Sail directly East or West under any Parallel, she there also altereth not her Latitude, but only the Longitude; yet not according to the number of Degrees of a *Great-Circle*, she hath Sailed as under the Equinoctial: but more than so many according as the Parallel is remoter from the Equinoctial towards the Pole: For the less any Parallel is, the greater is the Difference of Longitude in Sailing so many Degrees of a *Great-Circle*.

Oblique Sailing.

Oblique Sailing is when the ship runneth upon some Rumb between any of the four Cardinal Points: making an Oblique Angle with the Meridian. And then she changeth continually both Latitude and Longitude.

The Division of Navigation according to the Chart.

There be three kinds of Oblique Sailing, or rather methods of protracting the way and pricking down the place of the Ship.

Plain Sailing.

The first is called Plain Sailing, manifesting all the varieties of the Ships motion on a Plain, where all the Meridians are made parallel, and the parallels at Right Angles to the Meridians, and the Degrees of each parallel equal to those of the Equinoctial. Which though notoriously false in it self, supposing the Earth and Sea to be a plain flat, and each Parallel equal to the Equinoctial, yet by laying down places accordingly, and breaking a Long Voyage into many short ones, a Voyage may pretty well be performed thereby near the same Meridian.

Mercators Sailing.

The Second is called Mercators, *or more truly* Wrights *Sailing, or Sailing by* Wrights *Chart; which Demonstrateth also on a Plain the motion of the Ship upon any Course assigned, true in Longitude, Latitude and Distance, the Meridians being also Parallel, and the Parallels of Latitude strait Lines.*

Great-Circle Sailing.

The Third is Great Circle Sailing, which teacheth how upon or by a Great Circle passing through any two Places assigned, the Ship may be conducted by a skilful Seaman: and this is the shortest way between Place and Place that may be.

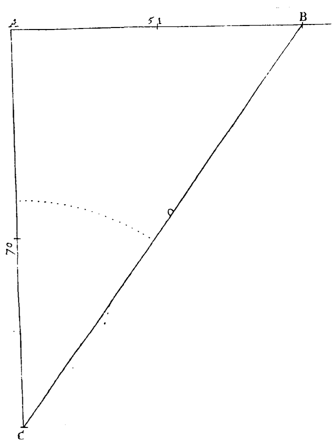
The Operation of all which three kinds shall be shewed by Delineations, or Geometrically if the use of a *Line of Chords* may be admitted as Geometrical by Computation, or Arithmetically, and Mechanically, or Instrumentally.

SECTION

SECTION II.

Plain SAILING.

FOR Methods sake make always the fore Part of the Book, Slate, or whatever else you draw or work upon, the North Part, that nearest to you the South, then will that towards the Right hand be the East, and that towards the Left hand the West; and imagine that by the Rumb Line, Meridian and Parallel of Latitude will always be formed a Right angled Triangle, as the Triangle B A C Right-angled at A, (for so shall the Right-angle be always marked throughout the work:) Then is that Part of the Meridian or North,



and

and South line contained between A and C the difference of Latitude, the side B A the departure, B C the distance sailed, the Angle C the Course, and the Angle B the Complement of the Course. Any two of which, with the Right Angle, being given, the Triangle may be protracted, and the other three Parts found, as in the following Examples will appear.

CASE I.

The Course and Distance given, to find the Difference of Latitude, and Departure from the Meridian.

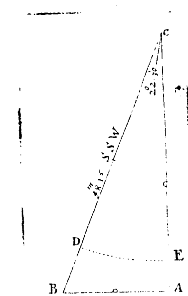
Admit a Ship from the Latitude 50° 10′ North, Sails SSW 48. 5 Miles: I require the Latitude she's in, and her Departure or Separation?

Geometrically.

First, Draw the North and South line A C, and taking with the Compasses 60° from the *Line of Chords* set (because she Sails Southward) one foot in some point towards the North on the said line A C as at C and describe the Arch D E, and lay thereon two Points or 22° 30′ the Course from E to D, and draw C B. *Geom.*

Secondly, taking the given distance 48. 5 *m.* from the *Line of Equal Parts*, lay it on the Rumb-line C B from C to B.

Lastly, from B let fall the Perpendicular B A, which includes the Triangle B A C, whose required Parts B A and A C being taken one after the other between the Compasses, may be measured, by applying them to the Scale.



Arithmetically.

Say, *As the Radius,*	10,0000000	*Arith.*
Is to the Distance run, B C 48.5*m.*	1,6857420	
So is the sine of the Course 22° 30′	9,5828397	
To the Departure 18. 56 *miles*	11,2685817	

Which in this Example is Westing.

A a

Then

Then again,

As the Radius	10,0000000
Is to the Distance B C 48.5 *Miles*	1,6857420
So is the Cosine of the Course S:67° 30′	9,9656153
To the Difference of Latitude C A 44.8 *Miles*	1,6513573

Which because she Sailed towards the Equator, I substract from the Latitude she set out from, *viz.* 50° 10′ and the Remainder 49° 25′ is the Latitude she's arrived in. If the Difference of Latitude C A had been more than 60 I must have divided by 60, and the quotient had been the Degrees, and the Remainder minutes, which must have been added or substracted as before.

50° 10′
0 45
49 25

By Gunters Scale.

Instru. Set one foot of the Compasses in the *Radius* or sine of 90°, and extend the other to two Points on the *sine Point Line*, or on 22° 30′ of the sines: Then keeping that extent set one foot in 48.5 of the *Line of Numbers*, and turning the other backwards, *viz.* that way you did turn it from the first term the *Radius*, to the third two Points, and the other foot will fall on 18.6 the Departure as before.

Again, set one foot in the *Radius* and extend the other to six Points (which is the Complement of two Points the Course:) then keeping that extent set one foot in 48.5 of the *Line of Numbers*, and turning the other foot backward it will fall on 44.8 the Difference of Latitude as above.

Which difference of Latitude and Departure being found by the estimate distance from the Log, which by many accidents is viciated, as by the Wind and Seas when high throwing it after the Ship, or Currents, &c. is naught and not to be relyed on, but as soon as the Sun or Stars appear, the Latitude ought to be observed by the Rules following towards the end of this Treatise, which if found differing from what it was made by the former way called *Dead Reckoning*, you must take the difference of this last observed Latitude, and the Latitude you departed from, and with this true difference of Latitude and the Course by the following Prop. find the departure and distance.

For the ready performance of this Prop. is the Table *Page* 59 of the *Vol.* of Tables. Thus, enter with the Course on the head, and with the distance down by the side, and you'l be directed by such entry to the departure and difference of Latitude.

Case

CASE 2.

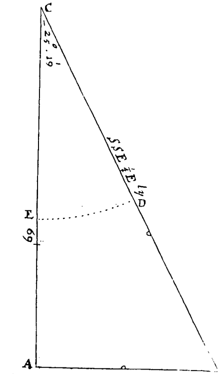
The Course and Difference of Latitude being given to find the Departure and Distance.

Admit a Ship Sail from Latitude 48° 30′ North, S S E ¼ Easterly till she be in Latitude 47° 21′: I demand the Departure and Distance Sailed.

Geometrically.

Geom. First, Draw the North and South Line C A and substracting the Latitudes one from the other take 69 Miles their difference, and set from C to A making the point C towards the upper or North end of the Line, and on A raise the Perpendicular B A. Lastly, taking the *Radius* and setting one foot in C, with the other describe the Arch D E, and lay thereon 2¼ Points or 25° 19′ from E to D and draw C D, which compleats the Triangle B A C, whose required Parts may be measured by the Scale.

48° 30′
47 21
1 09
60
69



Say,

Arithmetically.

Say, *As the Cosine of the Course* S: 64° 41′	9,9561483
Is to the Difference of Latitude 69 *Miles*	1,8388490
So is the Radius	10,0000000
	11,8388490
To the Distance Sailed B C 76.3	1,8827007
Then, *As the Radius*	10,0000000
Is to the Distance Sailed C B 76.3	1,8827010
So is the sine of the Course 2¼ *Points the* ∠ C	9,6310590
To the Departure A B 32.6 *Miles*	x1,5137600

Instrumentally.

Set one foot of the Compasses on the S R line in 5¾ Points the Compl. of the Course, and extend the other to the *Rad.* then keeping the Compasses at the same extent, set one foot in 69 the Difference of Latitude on the Line of Numbers, and turn the other forward, and it will fall on 76.3 the Distance Run.

Then, set one foot in the *Radius* and extend the other to 2¼ Points: afterward keeping the Compasses at that extent, set one foot in the Distance Sailed, and turn the other backward (because it was turned backward before from the Rad. to 2¼ Points) and it will will fall on 32.6 the Departure.

If having no cause to suspect the Distance for the former or any other Reasons, and are assured in your self of having made a good estimate thereof: but mistrust the care or skill of the Helmsman that he has let her yaw or fall off, or that you have neglected the Variation, then with the true Difference of Latitude, and the Distance by the following Prop. find the Course and Departure.

CASE 3.

The Difference of Latitude and Distance Sailed given, to find the Course and Departure.

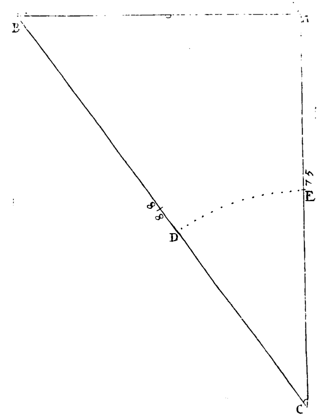
Admit a Ship sail from Latitude 42° 15′ North, on some Point between the North and West 88 Miles, and then finds her self in Latitude 43° 30′: I demand the Course and Departure.

Geome-

Geometrically.

Having drawn the Meridian Line A C, prick the Difference of Latitude 75 Miles from C to A, and on the Point A raise the Perpendicular B A: then take the Distance 88 Miles and setting one foot in C, with the other cross B A as it will somewhere as in B, and draw B C, now the line B A measured on the equal Parts is the Departure, also upon C as a Center with 60° of the Chords describe the Arch D E which measured on the Chords or Rumbs shews the Course 2¼ Points from the North Westward, *viz.* N N W ¼ Westerly. *Geom.*

43°	30′
42	15
1	15
60	
75	



Note

Note, that where ever a ſide is to be meaſured or laid down, as the Diſtance, Departure or Difference of Latitude, you muſt always uſe the equal Parts, but when an Angle, the Chords.

Arithmetically.

As the Diſtance Run BC 88.	1,9444827
Is to the Radius.	10,0000000
So is the Difference of Latitude CA 75	1,8750613
	11,8750613
To the Coſine of the Courſe, the Angle B 58° 27′	9,9305786

Whoſe Complement 31° 33′ is 2¾ Points from the Meridian which is N N W ¾ Weſterly.

Then, *As the Radius.*	10,0000000
Is to the Diſtance Run CB 88 *m.*	1,9444827
So is the ſine of the Courſe 31° 33′	9,7187030
To the Departure from the Meridian AB 46 *Miles Weſt.*	~~1~~1,6631857

By the Gunter.

Set one foot in 88 of the *Line of Numbers*, and extend the other to 75, then ſet one foot in the *Radius*, or ſine of 90° and turn the other backward, and it will fall in the ſine of 58° 27′ the Complement of the Courſe.

Again, Set one foot in the *Radius*, and extend the other to the ſine of 31° 33′; then ſet one foot in 88 *m.* and turn the other backward, and it will fall on 46 *m.* the ſeparation from the Meridian.

CASE 4.

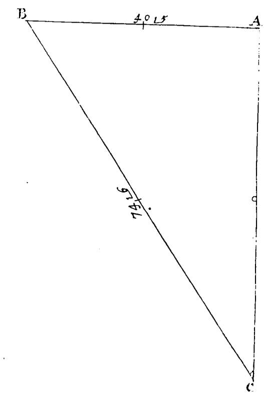
The Diſtance Run, and Departure from the Meridian given, to find the Courſe and Difference of Latitude.

A Ship being in the Latitude 59° 00′ N, Sails North Weſtward, 'till her diſtance Run be 74.6 Miles, and the Departure be 40.5: I demand the Courſe and Difference of Latitude, and conſequently the Latitude the ſhip is in.

Geom-

Geometrically.

Having drawn the Meridian A C on the point A, taken ſomewhere towards the upper, or North end of the Line (becauſe the Ship Sails Northward) raiſe the Perpendicular B A, laying thereon 40.5 Miles the Departure from A to B, then take the Diſtance 74.6 Miles, and ſetting one foot in B, with the other croſs the Meridian A C in C and draw B C.



Arith-

Arithmetically.

Arith.	*As the Distance Run* BC 74.6	1,8727388
	Is to the Radius	10,0000000
	So is the Departure BA 40.5	1,6074550
		11,6074550
	To the sine of the Course ∠ C 32° 53′	9,7347162

Which is three Points from the Meridian, *viz.* N W by N nearly.

Then, *As the Radius*	10,0000000
Is to the Distance BC 74.6	1,8727388
So is the Cosine of the Course 57° 7′	9,9241644
To the Difference of Latitude AC 62.6 *Miles*	✗1,7969032

Which turned into degrees is 1° 3′, and is to be added to 59° 00′ the Latitude she Departed from, because she Raises the Pole: so is the sum 51° 3′ the Latitude the Ship's in.

By the Gunter.

Instr. Set one foot of the Compasses in 74.6 Miles, and extend the other to 40.5, then keeping the same extent, set one foot in the sine of 90°, and turn the other backward, and it will fall on the sine of 32° 53′ the Course.

Again, Set one foot in the sine of 90°, and extend the other to the sine of 57° 7′ the Complement of the Course, then retaining the same extent, set one foot in 74.6 of the *Line of Numbers*, and turn the other backward, and it will fall on 62.6 the Departure.

CASE 5.

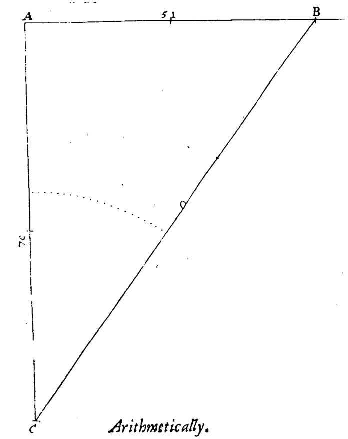
The Alteration of Latitude, and Departure from the Meridian given, to find the Course and Distance.

A Ship from Latitude 59° 00′ North, Sailes North Eastward 'till she has altered her Latitude 1° 10′ or 70 Miles, and is departed from the Meridian 51 Miles: I demand the Course and Distance.

Geom-

Geometrically.

Having drawn A C and laid thereon the 70*m.* from C to A, and on A raised the Perpendicular A B, lay 70*m.* from A to B and draw B C. *Geom.*



Arithmetically.

As the Difference of Latitude AC 70*m.*	1,8450980	*Arith.*
[illegible] *the Radius*	10,0000000	
[illegible] *is the Departure* AB 51	1,7075702	
	11,7075702	
[illegible] *Tangent of* [illegible] *Course* [illegible] ∠ C 6° 05′	9,8624722	

Which is [illegible] or N E by [illegible] N ly nearly.

Then, [illegible] *the sine of the Course* ∠ C 4[illegible]° 05′	[illegible]8760
Is to the Departure AB 51	[illegible]75702
So is the Radius	[illegible]0000
[illegible] *the Distance* BC [illegible]	

[illegible]

By the Gunter.

Instr. Set one foot of the Compaſſes in 70 *m.* and extend the other to 51 of the Line of Numbers, then keeping the ſame extent, ſet one foot in the Tangent of 45°, turning the other backward, and it will fall on the Tangent 43° 14′ the Courſe.

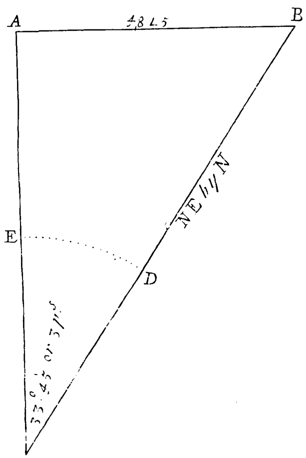
Again, Set one foot in the ſine of 43° 14′, and extend the other to the ſine of 90°, then keeping the ſame extent, ſet one foot in 51 of the Line of Numbers, turning the other forward, and it will on 74.4 the Diſtance.

This Propoſition is of uſe at the beginning of a Voyage or cloſe of a Traverſe.

CASE 6.

The Courſe and Departure given, to find the Diſtance and Difference of Latitude.

A Ship from the Latitude 48°.30′ N, sailes NE by N till her departure from the Meridian be 48 m L5. what is ye distance Sailed and difference of Lat:



Geom-

Geometrically.

Having drawn the Meridian A C, and on the point C, taken ſomewhere towards the lower or South end, as a Center, with the Chord of 60° deſcribed the Arch D E, and laid thereon three Points from E to D, and thereby drawn the Rumb-line C B, at the extent 48.5 taken from the Scale of equal Parts, draw a parallel to A C, as F G, cutting the Rumb-line in B, from which point B let fall a Perpendicular to A C, as B A. Geom.

Arithmetically.

As the ſine of the Courſe 33° 45′	9,7447390	Arith.
Is to the Departure A B 48.5	1,6857417	
So is the Radius,	10,0000000	
	11,6857417	
To the Diſtance C B 87.3 *Leagues.*	1,9410027	
Then, *As the Radius,*	10,0000000	
Is to the diſtance Run C B 87.3	1,9410027	
So is the Coſine of the Courſe, S: 56° 15′	9,9198464	
	11,8608491	
To the Difference of Latitude A C 72.6	1,8608191	

By the Gunter.

Set one foot of the Compaſſes in the ſine of three Points, and extend the other to the *Radius*, or ſine of eight Points; then keeping that extent, ſet one foot in 48.5 of the Line of Numbers, and turn the other forward, and it will fall on 87.3 the Diſtance Sailed. Inſtr.

Again, Set one foot in the ſine of eight Points, and extend the other to the ſine of five Points: then ſet one foot in 87.3 Leagues, and turn the other backward, and it will fall on 72.6 Leagues; the Difference of Latitude, which is 217.8 Miles or Minutes which divided by 60 makes 3° 37′ which becauſe ſhe *raiſeth the Pole.* I add to 48° 30′ the Latitude ſhe departed from, and the ſum 52° 7′ is the Latitude ſhe's arrived in.

8 Ps.
3 Ps.
5 Ps.

A

A TRAVERSE.

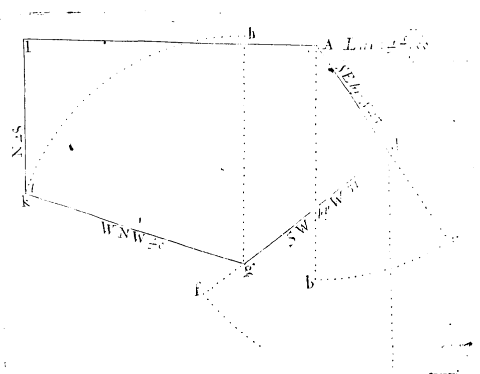
A Traverſe is the Variation or Alteration of the Ships Courſe upon the ſhifting of Winds, &c.

Note, That Sailing in reſpect of the wind is either *before a Wind, by a Wind, or Larging.*

If a Ship Sail by or againſt a wind there ought to be an allowance for her Lee-way, and that more or leſs according to the growth and ſurge of the Sea, and mould of the Ship, and Sail ſhe bears, &c.

Example 1. *Of a Traverſe.*

A Ship from Latitude 47° 00′ N, Sails SE by S 23 Miles, and then Sails S W by W 31 Miles, and afterwards W N W 40 *m.* and laſtly, N 28 *m.* I demand the Courſe and Diſtance Sailed from the firſt place of Departure, and the Latitude ſhe's now in.



Geom-

Geometrically.

Take any convenient point on your Slate or Paper, for the Ships place at firſt, as A, and from thence having drawn the Meridian A *b*, with 60° of the Chords deſcribe the Arch *b c*, and lay thereon 23 Miles from A to *d*, ſo have you protracted the firſt Courſe and Diſtance. *Geom.*

Secondly, Through the point *d*, draw the Meridian *d e* parallel to A *b*, and with 60° of the Chords ſetting one foot of the Compaſſes in *d* as a Center deſcribe the Arch *e f*, laying thereon 5 points from *e* to *f*, and draw *d f*, then prick 31 Miles from *d* to *g* on the Line *d f*, ſo have you laid down the ſecond Courſe and Diſtance.

Thirdly, From the point *g* draw *g h* parallel to A *b*, and with 60° of the Chords deſcribe the Arch *h i*, laying thereon ſix points from *h* to *i*, and draw *g i*, then prick 40 Miles from *g* to *k*.

Fourthly, From *k* draw the Meridian *k l* parallel to A *b*, and becauſe ſhe Sailes now under the very Meridian it ſelf, lay 28 *m.* the Diſtance on this Rumb from *k* to *l*, which point *l* is the Ships place at the end of this Traverſe: then draw *l* A, and that meaſured on the line of equal Parts or Miles gives 50.4 *m.* the diſtance from the place of Departure, and the Angle A *l k* being meaſured on the Chords gives 82° or $7\frac{1}{4}$ Points from the Meridian, ſo that if ſhe had Sailed on a ſtrait line, and ſingle Courſe from the firſt point A to *l* that Courſe had been W by N¼ Weſterly, and the Diſtance 50.4 *m*, and if ſhe were to Sail back again from *l* to A, ſhe muſt ſtand E by S¼ Eaſterly till ſhe has run 50.4 *m.*

Arithmetically.

As the Radius,	10,0000000	*Arith.*
Is to the Diſtance on the firſt Courſe 23 *m.*	1,3617278	
So is the ſine Complement of the Courſe S: 56° 15′	9,9198464	
To the Difference of Latitude in the firſt Courſe 19.1 *Miles.*	~~1~~1,2815742	
Then, *As the Radius.*	10,0000000	
Is to the Diſtance A *l* 23 *m. Run on the firſt Courſe*	1,3617278	
So is the ſine of 3Ps. *or* 33° 45′ ∠ *d* A B *the firſt Courſe*	9,7447390	
To the Departure in the firſt Courſe 12.8	~~1~~1,1064668	

Thus proceeding with the ſeveral Courſes and Diſtances given, find the Departures and Difference of Latitude to them all.

If

If the Courſe be between the North and Eaſt, then the Difference of Latitude is called Northing, and the Departure Eaſting; if the Courſe be in the North Weſt Quarter, then the Difference of Latitude is called Northing and the Departure Weſting: If the Courſe be between the South and Eaſt the Difference of Latitude is called Southing, and the Departure Eaſting, &c.

Now place all the ſaid Differences of Latitude and Departures in a Table, the Northings all under one another under the Title *Northing*, and the Southings under *Southing*, the Eaſtings in the *Eaſt* Collumn, and the Weſting in the *Weſt* Collumn, as as in the ſpecimen.

Then add up all the Northings, as likewiſe the Southings, and ſo the Eaſtings and alſo the Weſtings; Laſtly, take the ſum of the Northings from that of the Southings if the Southings make moſt, or the ſum of the Southings from the Northings, that you may have their Difference, which is the Difference of Latitude; alſo take the Difference of the Totals of Eaſting and Weſting for the Departure; by which Difference of Latitude and Departure, according to Caſe fifth, find the direct Courſe and Diſtance.

Lat. departed from	47° 00′	N,
Diff. of Lat.	0 07	
Lat. ſhe's in	47 7	N,

Courſe	*Points.*	*Diſt.*	*North*	*South*	*Eaſt*	*Weſt*
S E by S	3	23		19 12	12 78	
S W by W	5	31		17 22		25 78
W N W	6	40	15 31			36 96
North	0	28	28 00			
from ſum			43 31	36 34	12 78	62 74
take			36 34			12 78
Reſts			6 57			49 96

Dep. Weſt.

As the Difference of Latitude 7 *m.*	0,8450980
Is to the Radius.	10,0000000
So is the Departure 49.9 *m.*	1,6981005
	11,6981005
To the Tangent of the Courſe, 82° 1′	10,8530025
And, *As the ſine of the Courſe* 82° 1′	9,9957705
Is to the Departure 49.9 *Miles*	1,6981005
So is the Radius	10,0000000
	11,6981005
To the Diſtance 50.4 *Miles*	1,7023300

By

By the Gunter.

Set one foot in eight Points, and extend the other to three Points, then with the ſame extent ſet one foot in 23 *m.* and turn the other backwards, and it will fall in 12.8 the Eaſting in the firſt Courſe. *Inſtr.*

8 Ps.
3 Ps.
5 Ps.

Set one foot in eight Points, and extend the other to five Points, Then ſet one foot in 23 *m.* and turn the other backward, and it will fall in 19.1 the Southing in the firſt Courſe.

Secondly, Set one foot in eight Points, and extend the other to five Points, Then keeping the ſame extent ſet one foot in 31 *m.* turning the other backward, and it will fall on 25.8 the Weſting in the ſecond Courſe.

8 Ps.
5 Ps.
3 Ps.

Set one foot in eight Points, and extend the other to three Points; Then keeping the ſame extent ſet one foot in 31 *m.* turning the other backward, and it will fall in 17.2 the Southing in the ſecond Courſe.

Thirdly, Set one foot in eight Points, and extend the other to ſix Points; Then retaining the ſame extent ſet one foot in 40 *m.* turning the other backward, and it will fall on 36.9 the Weſting in the third Courſe.

8 Ps.
6 Ps.
2 Ps.

Set one foot in eight Points, and extend the other to two Points, Then ſet one foot in 40 *m.* turning the other backward, and it will fall on 15.3 the Northing in the third Courſe, which Northings, Southings, Eaſtings, &c. being collected as before, and the ſums of Differing Denomination ſubtracted, the Difference of Latitude will be 7 *m.* North, and the Departure 49.9 *m.* Weſt.

Then ſet one foot in 49.9 *m.* and extend the other to 7 *m.* afterwards remove one foot to *t.* 45° turning the other backward, and it will fall on 82° which is the Courſe from the North Weſtward.

Again, Set one foot in the ſine of 82°, and extend the other to the ſine of 90 Degrees, then keeping the Compaſſes at the ſame extent, ſet one foot in 49.9 turning the other backward, and it will fall on 50.4 *m.* the direct Diſtance from the firſt place of Departure.

Example 2.

A Ship being bound to the Eaſtward, and finding the Wind Variable, a ſmall Gale, and ſmooth water, plies upon theſe ſeveral Courſes, with the Diſtances on each Courſe as followeth.

The

The Lar-board Tack on Board, Wind from S S W *to* S, *and so to* S S E *and* E.

	Miles.
South East by East ½ Easterly,	5
East South East,	4
East by South,	7
East ½ Northerly.	3

The Star-board Tack on Board, the Wind S E, E S E, E, *&c.*

South South West,	5
South by West,	6
South,	4
South South East,	7
South East by South.	3

I require the Direct Course and Distance from the first place of Departure.

The manner of delineating it is omitted, I presuming it's well enough understood, by what has been said on the first Example.

The

The Work by the Traverse Table.

Course	*Points.*	*Dist.*	*North*	*South*	*East*	*West*
S E by E ½ Ely	5½	5		2 36	4 41	
E S E	6	4		1 53	3 70	
E by S	7	7		1 37	6 86	
E ½ Nly	7½	3	0 29		2 98	
S S W	2	5		4 62		1 91
S by W	1	6		5 88		1 17
South	0	4		4 00		0 00
S S E	2	7		6 47	2 08	
S E by S	3	3		2 49	1 67	
Sum			0 29	28 72	21 70	3 08
				0 29	3 08	
				28 43	18 62	

Having drawn several Columns, and therein set down the several Courses and Distances as in the specimen, turn to the *Traverse Table*, Page 59, of the *Volum* of Tables, looking the Course on the head of the Table if under four Points, but at the bottom if above four Points; and look the Distance in the left hand Column, and in the square of meeting will be the Difference of Latitude and Departure under the respective Titles.

Thus, Above 5½ Points and right against 5 *m.* I find over the Title Diff. Lat. 2.36 *m.* the Diff. of Lat. and over *Dep.* 4.14 *m.* the Departure in the first Course, which being placed in their proper Columns according as they are Northing or Southing, *&c.* Proceed in like manner with all the other Courses and Distances entering the corresponding Differences of Latitude and Departures in their Columns: then add up the Columns of Difference of Latitude and Departure, subtracting the lesser Difference of Latitude from the greater, and the lesser Departure from the greater and the Remainders are the whole Difference of Latitude and Departure, she hath made from the place of her Departure: So in this Example she's 28.43 *m.* to the South of the Place of Departure, and 18.62 *m.* East, with which by Case fifth I find her Course S E by S 2° Southerly, and Distance 34.5 *m.*

C c As

As I have intimated in a ſingle Courſe that the account by Courſe and Diſtance is not altogether to be truſted to, ſo here I ſay care muſt be taken as often as may be to make obſervations by which to correct the dead Account; the manner how to correct it from Obſervations ſhall be explicated in the following Examples.

Example 3.

Anno 1672, From the 25*th.* of *July* to the 26*th.* the Courſes and Diſtances Sailed by the *Log* were,

	m.
E	32
E N E	22
N E by E	4
S W by S	20
S S W	5
	83

A Wind from the S S E Variable to the S E by S an indifferent Gale, and the variation of the Compaſs by Obſervation 5° Eaſt, The true Courſe and direct Diſtance is required.

The work by the Traverſe Table.

Courſe	*Points.*	*Diſt.*	*North*	*South*	*Eaſt*	*Weſt*
Eaſt	8	32			32 00	
E N E	6	22	8 42		20 32	
N E by E	5	4	2 22		3 32	
S W by S	3	20		16 63		11 11
S S W	2	5		4 62		1 91
			10 64	21 25	55 64	13 02
				10 64	13 02	
				10 61	42 62	

The Courſe being Computed by the former Method is Eaſt 14° South, and the Diſtance 44 *m.* but by reaſon of the Variation the true Courſe is Eaſt 19° South, with which and the Diſtance 44*m.* I work for the Difference of Latitude and Departure by Caſe 1, and find the Difference to be 14.3 *m.* and the Departure 41.6 *m.* My Latitude by Obſervation on the 25*th.* day was 29° 12′, and this day by Obſervation 29° 22′ S, the Difference is but 10′ which is 4 *m.* leſs than

Lat.	29° 22′
	29 12
	10

than the former, ſo that I am 4′ more Northerly than I eſtimated by my dead reckoning, which difference between the Obſerved and dead Latitude muſt be attributed to ſomething.

But I have no cauſe to ſuſpect my Courſe, and have been careful in trying and find no current, therefore I conclude it's cauſed by her Leecaſt; then by the true Difference of Latitude 10′, and the Diſtance 44 *m.* I compute my Courſe again according to *Caſe* 3. and find it E 13° S, which will give my Departure 43 *m.* and Difference of Latitude 10′ according to Obſervation. But if having been well experienced in the qualities of my Ship, and certain what allowance to have made for her Lee-way, yet had not Obſerved the Variation, I ſhould have argued another way, and attributed the error to a Variation eſpecially if I had made any Tryal for a Current.

Then to be able to give a good account of the Ships place is no light eaſie thing, but requires beſides an experienced judgment in eſtimating the Ships way, and frequent Obſervation of the Latitude, a perfect underſtanding the Qualifications of the Ship, a true and conſtant Obſervation of the Variation, and no long omiſſion of the tryal for the diſcovery of Currents.

If there be an omiſſion of the Obſervation of any one of theſe, it may nevertheleſs be found by the other: but if two or more be omitted, it will be doubtful to which of them to attribute the error, and conſequently, hardly any true correction to be made. Yet note this, that if you have omitted every thing but the Courſe and Diſtance, as moſt commonly it happens, then if the Courſe be leſs than four points from the Meridian, take the Courſe to be true, and with that and the true Difference of Latitude find the Departure.

But if the Courſe be above four Points from the Meridian, take your Diſtance and true Difference of Latitude produced by obſervation, and by them find the Departure, and once in two or three days if it may be obſerve carefully the Variation, which will confirm you much in the truth of your account of Eaſting or Weſting, if true or elſe manifeſt to you an error, as well as perfect your Courſe; for it's regular and orderly to them that well obſerve it.

Many neglecting the Obſervation of the Variation, by arguing from their Reckonings, many times talk of Variation where there's none, and ſometimes Eaſt Variation when it's Weſt, and ſometimes tell us of no Variation or a ſudden mutation where there's a great Variation and very regular. Others again carrying an *Azimuth* Compaſs, and being acquainted with the manner of obſerving the Variation, lay all errors in Reckoning to Currents making many hundreds more than really are or can be.

Example 4.

From *July* 26*th*, at noon, to *Noon* the 27*th*, the Courſes and Diſtances Sailed by the *Log* were,

E N E	60 *m.*
E N E ½ Nly	24
N E by E	14.
	98

The wind at N by W and N; fair weather but a freſh Gale, and a deep Northern Sea; and the Variation 17° Weſt by Obſervation. The true Courſe and Diſtance is required.

	25°	20'
Variat:	17	
	42	20
Lee-way	11	15
True Courſe	31	5

Courſes	*Points.*	*Diſt.*	*North*	*South*	*Eaſt*	*Weſt*
E N E	6	60	22 58		55 43	
E N E ½ Nly.	5½	24	11 31		21 17	
N E by E	5	15	7 78		11 64	
			41 67		88 24	

The Courſe computed from this tabular Difference of Latitude and Departure, is Eaſt 25° 20′ Nly, and the Diſtance 98 Miles, but by reaſon of the Variation her Courſe is Eaſt 42° 20′ N, and after the allowance of a Point Lee-way Eaſt 31° Nly; with which and the diſtance 98 *m.* I find the Difference of Latitude 50′ and the Departure 84′ Eaſt, but by my Obſervation I make my Difference of Latitude 58′, *Scilicet* 8′ more than my account, which I attribute to a ſtream.

To make a PLAIN CHART.

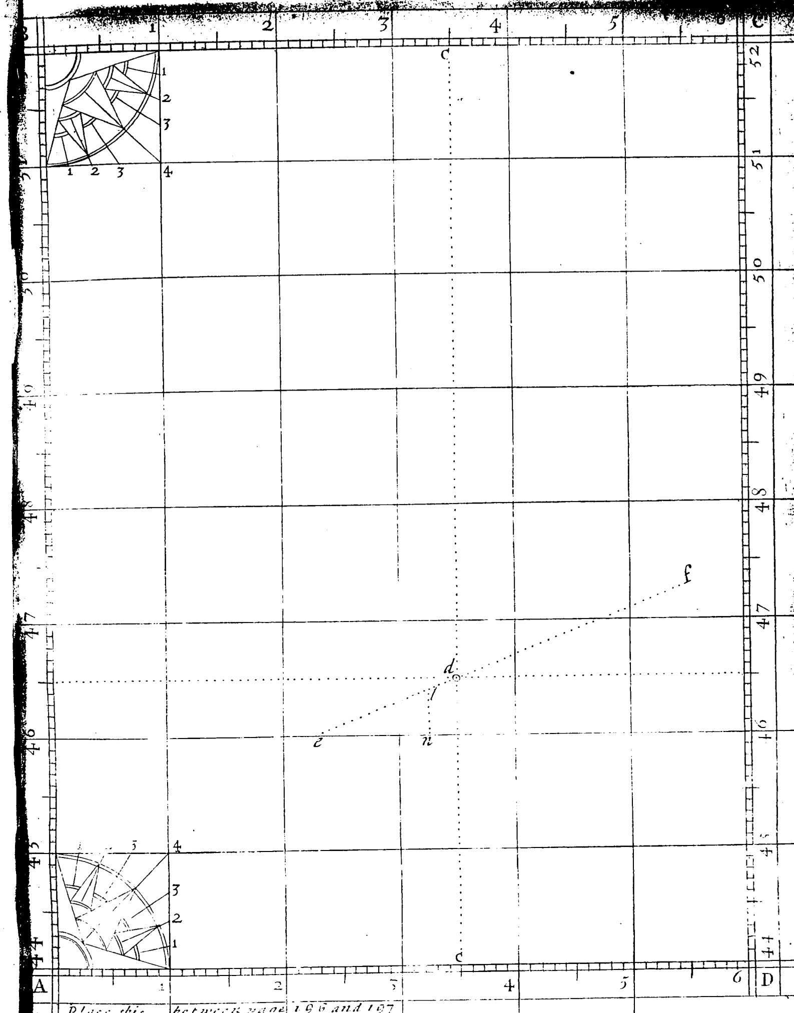
Let it be required to make a Particular Chart for a Voyage between the Parallels of 44° and 52° North Latitude, and to contain 6° of Longitude.

Firſt draw the Meridian or North and South Line A B, and croſs it at right Angles in the Point A, with another right Line A D repreſenting the Parallel of 44°.

$$\begin{array}{r} 52 \\ 44 \\ \hline 8 \end{array}$$

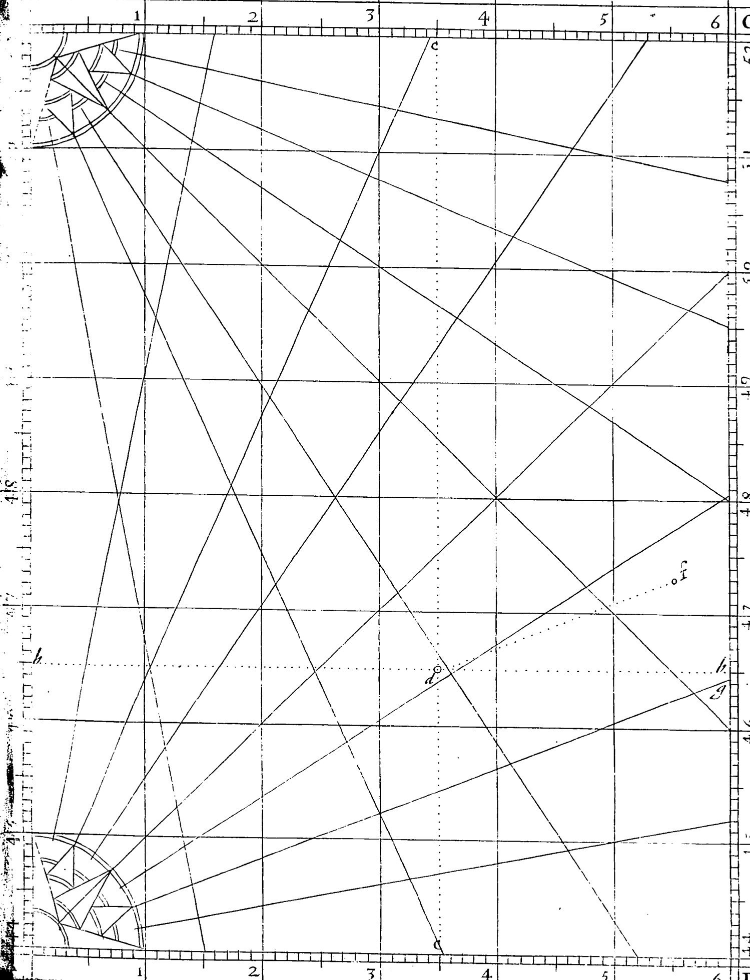
Then taking any convenient length for a Degree, Prick it ſeven times from A to B marking them 44, 45, 46, &c. and five times from A to D marking them 1, 2, 3, &c.

Through

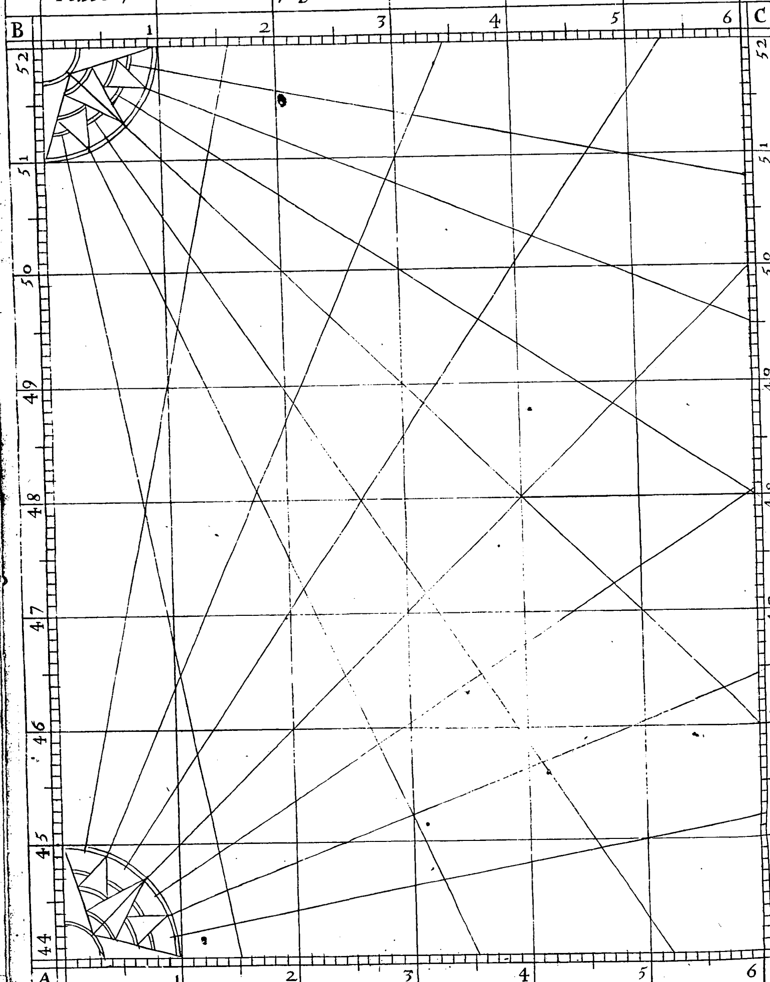


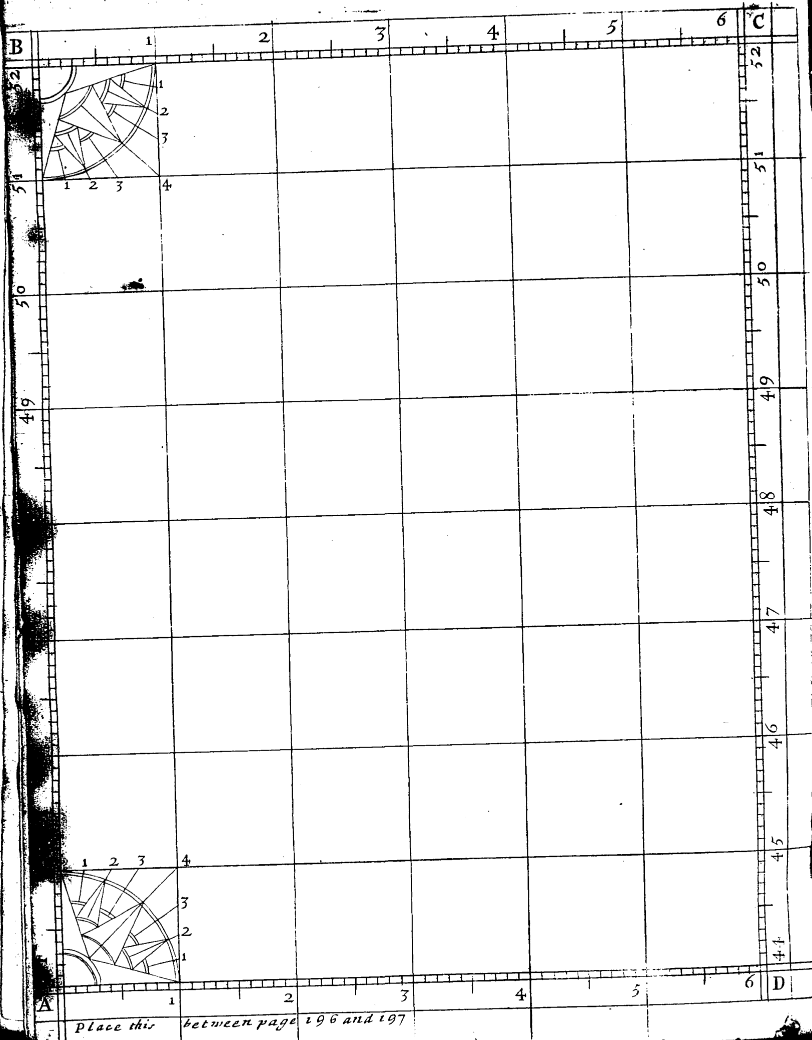
Place this between page 196 and 197

1d



Place this between page 196 and 197





Through D, 5, 4, 3, 2, &c. draw parallels to A B for Meridians, and through B, 50, 49, 48, &c. parallels to A D for Parallels of Latitude, subdividing each Degree both of the extream Parallels and Meridians into 60, 30, 20, 10, or 12, equal Parts as it will bear, in some convenient place depicting the Compass, with the Rumb-lines drawn forth quite through the Chart.

To lay down a Place on the Chart.

Let A represent some place in the Latitude 44°, and I would lay down another Place that's 3° 30′ East thereof, and in Latitude 46° 30′ North.

First, Laying a Ruler over 46° 30′ of the extream Meridians, draw the Parallel of 46° 30′ as *b b*, and laying it over 3° 30′ of the extream Parallels draw the Meridian *c c*, and where this Meridian and Parallel cross, as at *d*, is the Place required.

But if I had been to lay down the Place *d* by a Course and Distance given, as suppose I know it should lie North East from A: then from A I draw a Parallel to the North East Rumb-line as A *d*, and taking five Degrees or 300 *m.* from the Meridian-line, set it from A on the Line A *d* to *d*.

If I had been to lay it down by the Course and Latitude, by a Ruler over 46° 30′ of the extream Meridians, I draw the Parallel of Latitude *b b*, and from A a parallel to the North East Rumb-line as A *d*, and where these cut one the other as at *d* is the Place to be laid down.

If the Rumb-lines be not drawn on the Chart, you may prick down the line A *d*, by setting one foot in A as Center, with 60° of the Chords describing an obscure Arch, &c. after the Manner of Cases the first and second of this Section.

To find the Course and Distance between any two Places on the Chart.

Laying a Ruler over the two Places as *d f*, see what Rumb-line runs parallel thereto as A *g*, and that shews the Course, which from *d* to *f* is East North East.

But if the Rumb-line be not drawn, only a Compass Card depicted on some part of the Chart as in the second draft, then laying the Ruler over the Places, see how it cuts the Parallels of Latitude or Meridians as in *h* and *l*, taking *a h*, set it from *e* to *n*, and taking *n l* apply it to the side of the square wherein the Compass is, and it shews the Course 2 Points from the East neerly. Then take the extent *d f* and apply it to the Scale if there be one, or else apply it to the Meridian, and so many Degrees as it's equal to, so many score Leagues are the Places distant.

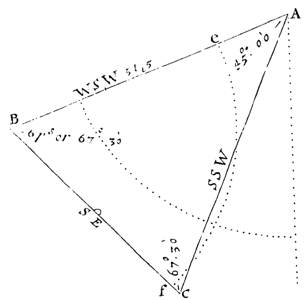
How

How to make a prick daily or weekly through a whole Voyage, on the Chart by the Courſes and Diſtances, needs no more inſtructions than what are already given at the beginning of this *Section* where I have delineated the *Traverſe*. I would adviſe all to keep their reckonings or account of the Voyage in Numbers daily correcting the *dead Reckoning*, and tabulizing the Correct Eaſtings and Weſtings, Northings and Southings in particular Columns, and then if at any time a man be deſirous to make a prick for the Ships place on his Chart, let him draw a Parallel of Latitude, and a Meridian at his true Departure and where they two cut will be the Ships place.

SECTION III.

Oblique Triangles applyed to Sailing.

1. COaſting a long the Shore, I ſet an Head-land C bearing off me S S W, I Sail W S W 51.5 Miles to B, and then the Head-land C bears S E from me: I demand my ſeveral Diſtances to the Head-land?



Geome-

Geometrically.

Taking any convenient point as A for the Place of the Ship at firſt, from thence draw a S S W line as A C and a W S W line as A B, and on A B prick 51.5 *m.* from A to B. Then, Setting one foot of the Compaſſes in B, with 60° of the Chords deſcribe the Arch *e f*, and lay thereon ſix Points (the Points between E N E and S E) from *e* to *f* drawing B *f*. *Geom.*

Arithmetically.

In the Triangle B A C is given the ſide B A 51.5 *m.* and all the Angles, *viz.* the Angle A 45° or 4 Ps, between the W S W and S S W, the Angle B between the E N E and S E ſix Points or 67° 30′, and the Angle C between the N W and N N E ſix Points, to find the ſides B C and C A. *Arith.*

As the ſine of the Angle at the Head-land s: C 6 *Points*	9,9656153
Is to the Diſtance run, A B 51.5 *miles*	1,7118072
So is the ſine of the Angle at the firſt Place of Obſervation s ∠ A 45° 00′,	9,8494850
	11,5612922
To the Diſtance B C 39.4	1,5956769

After the ſame manner you may find the Diſtance thereof from the firſt Place of Obſervation A, but in this Example for as much as the Angles B and C are equal, the ſide A C will be concluded equal to B A 51.5, without another work.

2. A Ship in the Parallel of 46° N at B, deſcries an Head-land at C diſtant from her 67 Miles, ſhe Sailes E S E 63 Miles to D, and then the Head-land at C bears S W by W from her. How did the Head-land bear from the Ship when ſhe was at B, and how far is it diſtant from her now ſhe's at D?

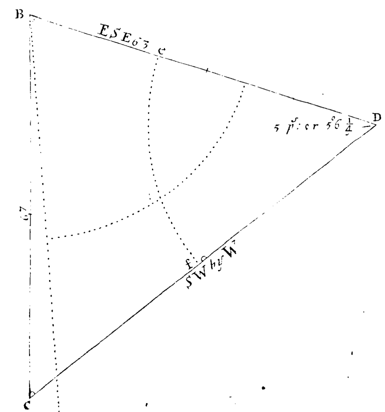
Geome-

Geometrically.

Geom. Take any convenient Point as B for the Place of the Ship at first, from thence draw a E S E line, and prick thereon 63 *m.* from B to D.

Then on D, as Center, with 60° of the Chords describe the arch *e f*, and prick five Points (the Points between W N W and S W by W) from *e* to *f* drawing D *f* C.

Lastly, Take 67 *m.* in the Compasses, and setting one foot in B, with the other cross D C in C, and draw B C.



Arithmetically.

Arith. *As the Distance* B C 67 *m.*	1,8260748
Is to the sine of the Angle D 56° 15′	9,9198464
So is the Distance Sailed B D 63 *m.*	1,7993405
	11,7191869
To the sine of the Angle C 51° 26′	9,8931121

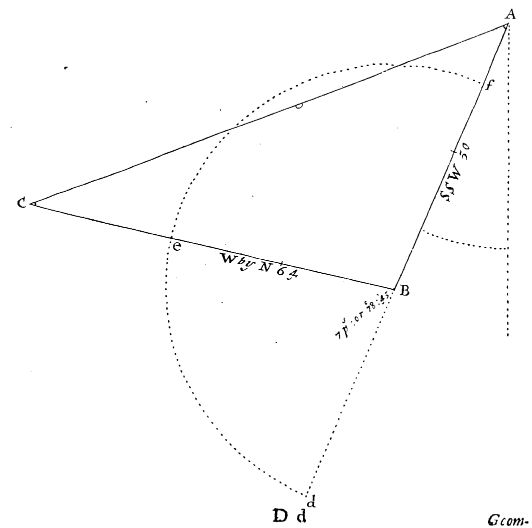
Or

51°	26′
56	15
107	41
180	00
72	19

Or $4\frac{1}{2}$ Ps. which added to the Angle D 56° 15′, and that sum taken from 180° the Remainder 72° 19′ or $6\frac{1}{2}$ Ps. is the Angle B, which added to the E S E gives the bearing of C to be S$\frac{1}{2}$ Wly *fere*.

Then, *As the sine of the Angle* D 56° 15′	9,9198464
Is to the Distance B C 67 *m.*	1,8260748
So is the sine of the Angle B 72° 19′	9,9789789
	11,8050537
To the Distance D C 76.8	1,8852073

3. If I Sail S S W 50 *miles*, and then W by N 64 *miles*. I demand the Course and direct distance from the place of Departure.



Geom-

Geometrically.

Geom. From A, the point taken for the Ships place at first, draw the S S W line, and lay thereon 50 *m.* from A to B. Then setting one foot of the Compasses in B with 60° of the Chords describe the semicircle *d e f*, and either prick seven Points (the Points between S S W and W by N) from *d* to *e*, or nine Points from *f* to *e*, and through *e* draw B *e* laying thereon 64 *m.* from B to C, lastly draw A C.

Arithmetically.

Arith. In the Triangle C B A there's given the two sides C B and B A, and the contained Angle C B A, nine Points, to find the Angles A and C, and the third side C A.

Therefore,

		As the sum of the two sides A B *and* B A, 114 *m.*	2,0569048
C B	64	*Is to their Difference* 14 *m.*	1,1461280
B A	50	*So is the Tangent of half the sum of the Angles* C *and* A: 39° 23'	9,9143020
Sum	114		
Diff.	14		11,0604300
		To the Tangent of half their difference 5° 45'	9,0035252

16 Ps.
9 Ps. ∠ B
7 Ps. = ∠ C + ∠ A
3½ Ps. the $\frac{C + A}{2}$

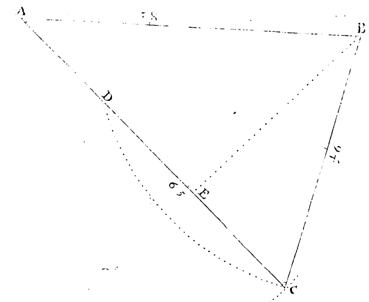
Which substracted from 39° 23' there remaines 33° 38' the Angle C: but 5° 45' added to 39° 23' makes 45° 8' the Angle A, wherefore seeing A D is a S S W line, A C is W S W nearly, *viz.* W S W 8' Wly.

Then for the Distance A C, say,

As the sine of the Angle A 45° 8'	9,8504930
Is to the Distance B C 64 *m.*	1,8061800
So is the sine of the Angle B 101° 15' *or rather its Compliment to* 180 *Degrees, viz.* 78 45'	9,9915739
	11,7977539
To the Distance A C 88.5 *m.*	1.9472609

4. Admit

4. Admit two Ports lying in the same Parallel or Latitude, differing in Longitude 58 *miles*, and a Ship having Sailed from the Westermost between the S and E 65 *miles*, be then 46 *miles* from the Eastermost: I demand the Course she steered, and her Course to the Eastermost Port.



Geometrically.

Having drawn an East and West line, and laid thereon 58 *m.* from A to B, take 65 *m.* in the Compasses, and setting one foot in A with the other describe an Arch, afterwards take 46 *m.* and setting one foot in B, with the other cross the former Arch in C, Lastly draw A C and B C.

Arithmetically.

	As A C 65 *m.*	1,8129134
58		
46	*Is to the sum of the distances* A B *and* B C, 104 *m.*	2,0170333
	So are their Difference 12 *miles.*	1,0791812
104		
		1,0962155
12	*To* A D 19.2.	1,2833011

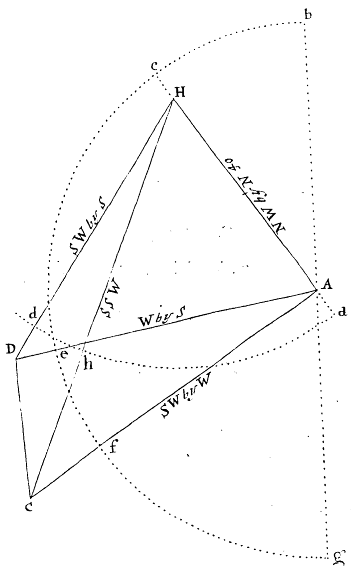
Which added to A C 65, makes 84.2 whose half 42.1 is A E.

Then,

Then, *As* A B 58 *m.*	1,7634280
Is to the Radius	10,0000000
So is A E 42.1	1,6242821
	11,6242821
To the Cosine of the Angle A 43° 28′	9,8608541

That is, S E 1° 32′ Ely, the Course she steered.

5. Coasting a long the Shore, I set two Head-lands, the one at C bearing S W by W, the other at D bearing W by S, I Sail away N W by N to H 40 Miles, and then the Head-land at C bears S S W, and that at D S W by S. I demand how far these Head-lands are asunder, and how they bear one from the other?



Geom-

Geometrically.

Geom. First, draw a North and South line as *b* A *g*, and with 60° of the Chords setting one foot on some convenient point for the Ships place at first as A, describe the semicircle *b e g*, then prick thereon five points from *g* to *f*, seven points from *g* to *e*, and three points from *b* to *c*, and draw A *f* C, A D *e*, and A H *c*, laying 40 *m.* from A to H

Secondly, Set one foot of the Compasses opened to 60° of the Chords on H, and describe the Arch *a d*, and prick thereon five points (the points between South East by South, and South South West) from *a* to *h*, and six points (being the points between the South East by South and South West by South) from *a* to *d*, and draw H *h* C, H D *d*, and D C. Then is D one Head-land and C the other.

Arithmetically.

Arith. In the Triangle H A C, there's given the Angle H A C, eight points (*viz.* the points between the South West by West, and the North West by North,) the Angle A H C five points (between the South East by South, and South South West) and the Angle A C H three points (the points between the North East by East and North North East,) and the side H A 40 Miles, to find the side C H.

Therefore,

As the sine of the Angle H C A 33° 45′	9,7447390
Is to A H 40 *Miles*	1,6020600
So is the sine of 90° *the Angle* H A C	10,0000000
	11,6020600
To the side H C 72 *Miles.*	1,8572310

Then in the Triangle D H A, there's given the Angle H A D six poins (*viz.* the points between the North West by North, and West by South,) and the Angle A H D six points (*Scil:* the points between the South East by South, and South West by South) and the Angle H D A four points (between the North East by North, and the East by North) and the side A H 40 Miles to find the side D H.

Thus,

Thus,

As the ſine of the Angle H D A 45° 00′	9,8494850
Is to the ſide A H 40 *Miles*	1,6020600
So is the ſine of the Angle H A D 67° 30′	9,9656153
	11,5676753
To D H 52.3 *Miles*	1,7181903

1
16 Ps.
1 Ps.
2) 15
7½ Ps.

Laſtly, In the Triangle D H C, there's given the two ſides C H 72 Miles, and D H 52.3 Miles, and their contained Angle C H D one point, to find the other two Angles H D C, H C D, and the third ſide D C.

As the ſum of the ſides H C *and* H D 124.3	2,0944711
Is to their Difference 19.7	1,2944662
So is the Tangent of half the ſum of Angles H D C *and* H C D 7½ *points or* 84° 22′	11,0059546
	12,3004208
To the Tangent of half their Difference 58° 6′	10,2059497

Which added to 84° 22′ makes 142° 28′ the Angle H D C, but ſubſtracted leaves 25° 16′ the Angle H C D which is North a quarter point Weſterly.

As the ſine of the Angle H C D 25° 16′	9,6302568
Is to D H 52.3 *Miles*	1,7181903
So is the ſine of the Angle D H C 11° 15′	9,2902357
	11,0084260
To D C 23.9 *Miles the Diſtance between the two Head-lands.*	1,3781692

SECTION

SECTION IV.

MERCATORS Sailing.

THough the *Plain Chart* be very deſirable for its eaſineſs, and very uſeful in ſhort Voyages, and will ſerve in the longeſt Voyages if a man Sail home in or neer the oppoſite Rumb he went by; as the Antients, who being Coaſters did before the Uſe of the Compaſs. Yet foraſmuch as few places or indeed none but ſuch as lie under the ſame Meridian, or under the Equinoctial, can therein be expreſſed according to their true Situation and diſtance one from another: but if they be laid down true by the Courſe and diſtance, the Difference of Longitude will be falſe; if they be laid down by the Courſe and Difference of Longitude, then will the diſtance and difference of Latitude be more than it ſhould be; and if they be laid down by their diſtance and difference of Longitude, which in many caſes is impoſſible, the difference of Latitude will always be too little, and the Rumb too wide from the Meridian; and if they be laid down by their Latitudes and Separation, then the Courſe will be wide and the diſtance too much, *&c.* And ſince that the places in Particular *Maps* or *Charts* being laid down in ſome one way, and in others another, and theſe Pieces many times tackt together without due conſideration of the differing Methods places have been laid down by, the *Geography* and *Hydrography* of the World is ſo corrupted, that there are ſcarce extant any Deſcriptions of the whole, or large parts, that are not notoriouſly erronious, and the ſhape of the Lands much diſtorted, it were to be wiſh'd that the World would not put over much value thereon, nor uſe it in the laying down Places, but by degrees as much as may be wean it ſelf from the uſe of the *Plain Chart*, and by making the *True Chart* eaſie and familiar bring it in requeſt and uſe, ſeeing there is ſuch a thing.

It was the great Study of our Predeceſſors, to contrive ſuch a *Chart* in *Plano* with ſtrait lines, on which all or any parts of the World might be truly ſet down according to their Longitudes, Latitudes, Bearings, and Diſtances; a way was hinted almoſt 2000 Years ſince by *Ptolomy*, and a general *Map* according thereto made in our preceding age by one *Mercator* (whence it's called *Mercators Chart*,) but the thing demonſtrated, and a ready way ſhew'd of deſcribing it, was not till Mr. *Wright* about 100 Years ſince taught to enlarge the Meridian-line, by the continual addition of Secants, ſo that all the Degrees of Latitude might be proportional to thoſe of Longitude, as on the Globe, which he has done after ſuch an excellent manner, that in many reſpects it's far more convenient for the *Navigators* uſe than the Globe it ſelf, and will truly ſhew the Courſe and Diſtance from Place to Place, which way ſoever a Ship Sail forth or returns.

To

To find the Meridional Miles or Minutes answering to any Difference of Latitude.

First, By the Table of Meridional Parts, *Page* 68*th* of the *Volum* of *Tables.* Look the Degrees of either Latitude over head, and the minutes in the left hand Colum downward, and in the Angle of meeting are the parts for that Latitude.

So also look out the parts for the other, then if both Latitudes be of the same name, that is both North or both South, subtract these one from the other, and that remainder contains the Meridional Miles sought.

Example 1.

Let it be required to find the Meridional Minutes or Miles, between Latitude 43° 15′ N, and 50° 20′ North.

Latitude	50° 20′	3505.7	Merid. Parts.
Latitude	43 15	2883.7	
The Meridional parts or Miles in the Difference of Latitude.		622.0	(Difference.

Example 2.

Let one Latitude be	20° 17′ S,	1243.2	Merid. Parts.
The other Latitude be	18 53 N,	1154.1	
The Merid. Miles between these two Latitudes.		2397.3	(Sum.

To find the Parts by the Table of Artificial Tangents.

The *Logar. Tangents* above 45°, accounting every 30′ to be one Degree, and every minute to be two minutes of the Meridian-line, are in the same *Ratio* with the Meridional parts made by the continual addition of *Nat. Secants.*

Therefore, Take half of each of the given Latitudes, and to each half add 45°, looking the Tangents of these Arches in the Table of *Logar. Tangents*, the difference of these *Tangents* divide by 1263, and the Quotient shall be the Meridional minutes or miles, or if you divide by 3789.7, the Quotient will be the inlarged Difference of Latitude in Leagues.

In

Example 1.

In the first of the former *Example*, Lat. 50° 20′ its ½ is 25° 10′ which added to 45° makes 70° 10′ the *Tangent* whereof is,	4428786
The ½ of *Lat.* 43° 15′ is 21° 37′ ½ which added to 45° makes 66° 37′ ½ the *Tangent* whereof is,	3642940

1263) 785846 (622 *the Merid. Miles as before.*
280
278
260

Example 2.

The ½ of Latitude 20° 17′ South, is 10° 8′ ½ which added to 45° makes 55° 8′ ½ the *Logar. Tangent* whereof is,	1570607
The ½ of the Latitude 18° 53′ is 9° 26° ½ which added to 45° makes 54 26° ½ the *Logar. Tangent* whereof is,	1457970

1263) 3028577 (2397 *The Miles between these two Latitudes.*
5016
123
100
1166

1. *The Latitudes and Difference of Longitude of two Places given, to find the Course and Distance.*

Admit the Course and distance between *Teneriffa* in Latitude 28° 20′ N, and St. *Michael* (one of the *Azores* Isles) in Latitude 38° 00′ N, whose Difference of Longitude is 8° 48′ be required.

E e Geome-

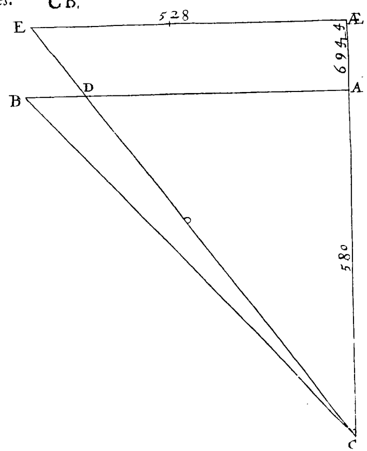
Geometrically.

Geom.

8°	48′
60	
528	*Miles.*

Latitude	38°	00′
Latitude	28	20
	9	40
	60	
	580	*Miles.*

Having drawn the Meridian Æ C, and laid 694.4 Miles, the Difference of Latitude enlarged from Æ to C, and on Æ raised a Perpendicular, prick 528 Miles, the Difference of Longitude on Æ E, from Æ to E, and draw C E, then prick 580 Miles the true Difference of Latitude from C to A, also on A raise a Perpendicular, as A B, pricking thereon 528 Miles from A to B, and draw C B.



Then is C the Isle *Teneriff*, B St. *Michael* according to the *Plain Chart*, E St. *Michael* according to the true *Chart*, B C the distance between them on the *Plain Chart*, C E the inlarged distance, and C D the true distance, B C the *Rumb-line* between them according to the *Plain Chart*, C E the true *Rumb-line*, B C A is the Course according to the *Plain Chart*, and E C Æ the true Course according to the *Mercators Chart*, E Æ is the true Difference of Longitude, A D the true Meridian distance or Departure.

For

For the Course.

Say,	*Arith.*
As the Difference of Latitude enlarged C Æ 694.5 *m.*	2,8416097
Is to the Radius,	10,0000000
So is the Difference of Longitude E Æ 528 *m.*	2,7226337
	12,7226339
To the Tangent of the true Course E C Æ 37° 15′	9,8810242

Which sheweth the Course from *Teneriff* to St. *Michael*, to be 3 $\frac{1}{4}$ points from the North Westward, that is N W by N $\frac{1}{4}$ W or neerer N W by N 3° 30′ Westerly.

For the Distance.

As the Cosine of the Course Cos: ∠E C Æ 37° 15′	9,9009142
Is to the Difference of Latitude C A 580 *miles*	2,7634280
So is the Radius,	10,0000000
	12,7634280
To the true Distance on the Rumb C D 728.7	2,8625138

But by measuring B C, I find the Distance according to the *Plain Chart* 784, so that the *Plain Chart* sheweth the Distance more than it is by 56 Miles, and the Course more Westerly than the truth by almost $\frac{1}{2}$ a point, and the Departure a great deal too much.

For the Course.

Set one foot of the Compasses in 694.4 on the Line of Numbers, and extend the other to 528; then keeping the same extent, set one foot on the *Tangent* of 45° turning the other backward, and it will fall on 37° 15′ the Course.

For the Distance.

90°	
37	15
52	45

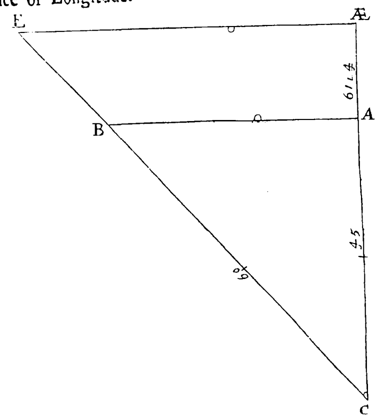
Set one foot in 52° 45′ of the Line of Sines, and extend the other to the sine of 90°, then keeping the same extent, set one foot in 580 of the *Line of Numbers*, and turn the other forward, and it will fall on 728.7 the Distance on the Rumb. There is a neerer passage between these two Places, which is by the Arch of a Great Circle; of which in its Place.

This *Proposition* is first of use in a Voyage.

2. *The*

2. *The Latitudes of two Places, and their Distance given, to find the Course and Difference of Longitude.*

A Ship from the Latitude 42° 30′ North, Sails North-westward 60 Miles, 'till she be in the Latitude 43° 15′. I demand the Course and Difference of Longitude.



Geometrically.

Geom. First, With the Difference of Latitude and Distance given, delineate according to the third *Proposition* of Plain Sailing. Then produce the Meridian and *Rumb-line*, and lay 61.4 the Difference of Latitude inlarged from C to Æ, Lastly, through Æ draw Æ E Parallel to B A.

43°	15′
42	30
0	45

For the Course.

As the Distance Sailed C B 60 *m.*	1,7781513
Is to the Radius,	10,0000000
So is the Difference of Latitude C A 45 *m.*	1,6532125
	11,6532125
To the sine Complement of the Course ∠ 41° 25′ *that is* N W by N 7° 40′ *Westerly.*	9,8750612

For the Difference of Longitude.

First, Find the Meridional Miles in the Difference of Latitude, which are here 61.4.

Then say,

As the Radius,	10,0000000
Is to the Difference of Latitude inlarged C Æ 61.4 *Miles,*	1,7881684
So is the Tangent of the Course t ∠ C 41° 25′	9,9455354
To the Difference of Longitude in Miles Æ E 541.7.	11,7337038

For the Course.

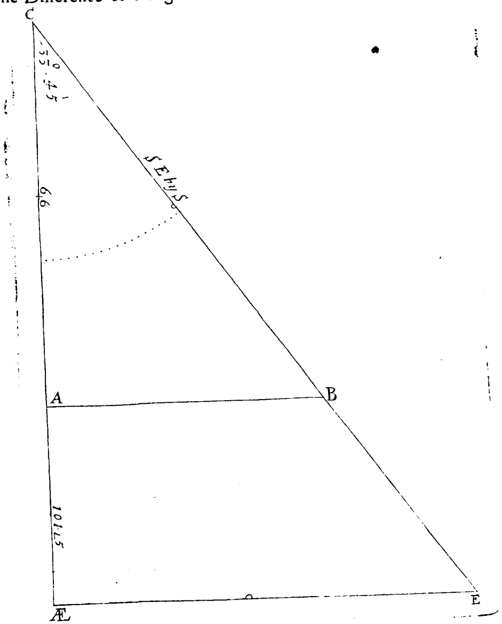
The extent of the Compasses from the Distance Sailed 60 *m.* to the Difference of Latitude 45 *m.* will reach (the same way) from the *Radius* to the sine of 41° 25′, the Complement of the Course, which subtracted from 90°, leaves the Course required.

For the Difference of Longitude.

The extent from the *Radius* t. 45°, to the *Tangent* of the Course 41° 25′, will reach from the Difference of Latitude inlarged 61.4 *m*, to the Difference of Longitude 54.17 *m.*

3. *Both Latitudes and the Course being given, to find the Distance and Difference of Longitude.*

A Ship from the Latitude 50° 00′ North, Sails South East by South, 'till she be in the Latitude 48° 54′ North, I demand the Distance Run and the Difference of Longitude.



Geometrically.

Geom.

50°	00′
48	54
1	06
60	
66	

Having drawn a Meridian line C Æ, described an Arch, laid thereon the Course, drawn the *Rumb-line* C E, and raised the Perpendicular B A, according to the second *Case* of *Plain Sailing*, inlarge the Latitude, and lay the Difference of Latitude inlarged 101.5 *m.* from C to Æ, and on Æ raise the Perpendicular Æ E.

For

For the Distance.

As the Cosine of the Course 33° 45′	9,9198464	*Arith.*
Is to the Difference of Latitude C A 66 *m.*	1,8195439	
So is the Radius	10,0000000	
	11,8195439	
To the Distance C B 79.3	1,8996975	

For the Difference of Longitude.

As the Radius,	10,0000000
Is to the Difference of Latitude inlarged C Æ 101.5 *miles,*	2,0064660
So is the Tangent of the Course t. ∠C 33° 45′	9,8248926
	x1,8313586
To the Difference of Longitude Æ E 67.8	1,8313586

4. *One*

4. *One Latitude, the Course and Difference of Longitude, being given, to find the other Latitude and the Distance.*

Admit I Sail from Latitude 32° 00′ North, North East by North 3° Easterly until I have altered my Longitude 1° 3′: How much have I raised the Pole, and what is my Distance Sailed?

Geometrically.

Geom.

1° 3′
60
63

33° 11′
32 00
1 11
60
71

Having drawn the Meridian C Æ, described an Arch, pricked thereon the Course, and drawn the *Rumb-line* C E, at the extent 63 of the equal Parts or Miles, draw a parallel to the Meridian C Æ as F E, and from the point E let fall a perpendicular to C Æ as E Æ; then add to the measure of C Æ 84.3 *m.* the Difference of Latitude inlarged the Meridional Miles for 32° 00′ of Latitude, and the sum looked in the Table of Meridional Parts gives 33° 11′ the Latitude she's arrived in.

Lastly, Subtract these Latitudes one from the other, and the difference turned into Miles prick from C to A, through A drawing A B parallel to Æ E.

For the Difference of Latitude.

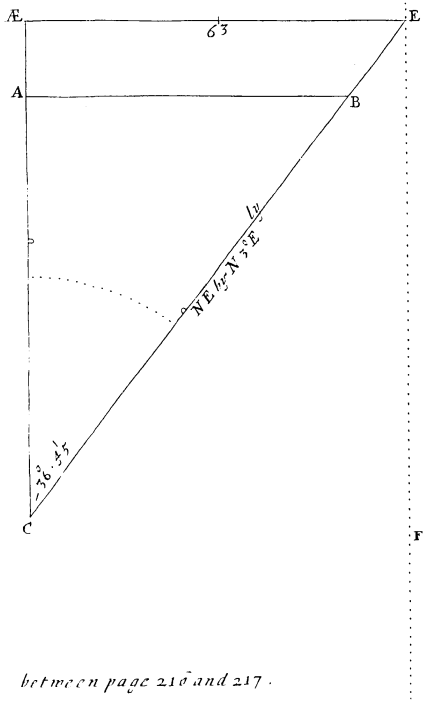
Arith.

As the Tangent of the Course the Angle C 36° 45′	9,8731668
Is to the Difference of Longitude E Æ 63 *miles,*	1,7993405
So is the Radius	10,0000000
	11,7993405
To the Difference of Latitude inlarged C Æ 84.3	1,9261737

The Meridional Miles answering to 32° 00′ *of Latitude are*	2028.4
To which add	84.3
The Sum is	2112.7

Which looked in the Table of Meridional parts gives the Latitude 33° 11′.

For



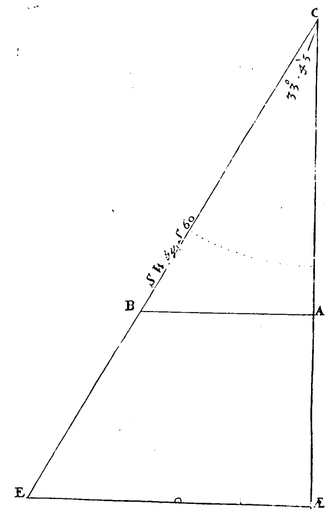
between page 216 and 217.

For the Distance.

As the Cosine of the Course 36° 45'	9,9037701
Is to the true Difference of Latitude A C 71 *Miles*	1,8512583
So is the Radius	10,0000000
	11,8512583
To the Distance C B 88.7 *Miles*	1,9474882

5. *The Course and Distance and one Latitude being given, to find the other Latitude and the Difference of Longitude.*

If a Ship from Latitude 53° 30' North, Sail South West by South 60 Miles; what Latitude will she then be in, and what will be the Difference of Longitude?



First,

Firſt, Protract the Courſe and Diſtance according to *Caſe* firſt of *Plain Sailing*.

Then meaſure the Difference of Latitude C A, and that meaſure ſubtract (becauſe ſhe depreſſes the Pole) from Latitude 53° 30′, and the remainder 52° 40′ is the Latitude ſhe's arrived in.

53°	30′
0	50
52	40

Thirdly, by the Table of Meridional Parts find the inlarged Difference of Latitude as formerly directed, and prick that, *viz.* 83.2 from C to Æ.

Laſtly, On Æ raiſe a perpendicular to C Æ as Æ E, and produce the *Rumb-line* B C 'till it meets which Æ E.

For the Difference of Latitude.

Arith.

As the Radius,	10,0000000
Is to the diſtance Sailed B C 60 *miles.*	1,7781512
So is the Coſine of the Courſe 33° 45′	9,9198464
	11,6979976
To the Difference of Latitude C A 50 *miles or minutes.*	1,6979976

Which ſubtracted from 53° 30′ leaves 52° 40′ the Latitude required, the difference of which two Latitudes inlarged is 83.2.

For the Difference of Longitude.

As the Radius,	10,0000000
Is to the Difference of Latitude inlarged C Æ 83.2 *miles.*	1,9201233
So is the Tangent of the Courſe 33° 45′	9,8248926
	11,7450159
To the Difference of Longitude Æ E 55.6 *miles,*	1,7450159

For the Difference of Latitude.

By the Gunter. Set one foot in the ſine of 90°, and extend the other to the ſine of 56° 15′. Then keeping the ſame extent ſet one foot in 60 on the *Line of Numbers*, and the other turned backward will fall on 50 Miles the Difference of Latitude, which becauſe ſhe *depreſſes the Pole*, ſubtract from 53° 30′, and the remainder 52° 40′ is the Latitude the Ship is in. The Difference of which two Latitudes inlarged is 83.2.

For

For the Difference of Longitude.

Set one foot of the Compaſſes in the *Tangent* of 45° 00′, and extend the other to the *Tangent* of 33° 45′: then keeping the ſame extent ſet one foot in 83.2 on the *Line of Numbers*, and turn the other foot backward and it will fall on 55.6 *m.* the Difference of Longitude.

There be ſeveral other Propoſitions of *Mercators* Sailing, as

6. By the one Latitude, Diſtance Sailed, and Departure, to find the Courſe, Latitude the Ship is in, and the Difference of Longitude.
7. By the Departure, and both Latitudes given, to find the Diſtance Sailed, Difference of Longitude and Courſe.
8. The Courſe, one Latitude, and the Departure given, to find the Diſtance, Difference of Latitude, and Difference of Longitude.

But theſe being of no great uſe I ſhall omit, and inſert two or three Propoſitions of Sailing under a Parallel of Latitude.

1. The

1. *The Difference of Longitude between two Places both in one Parallel or Latitude being given, to find the Distance between them.*

If a Ship Sail in the Latitude of 51° 30' 'till her Difference of Longitude be 4° 00': what will be the Distance Sailed?

Geometrically.

Geom. First, Draw a strait line A C, and setting one foot of the Compasses in A with 60° of the Chords describe the Arch N P M, and prick thereon 51° 30' the Latitude from P both ways to N and M: then laying a Ruler from M to N mark the line A P in R, afterwards prick A R from R to L, that is, double A R and also A P, and describe the Arches L B, C D.

4°	00'
20	
80	

Lastly, Taking 80 Leagues from the Line of equal Parts, prick it from C to D, and draw C D, and D A and B L. Then is A the Pole, A C and A D two Meridians, D C an arch of the Equinoctial, B L an arch of the Parallel of 51° 30' Latitude, A R is the Cosine of the Latitude, A L is equal to A R doubled, and A C is equal to A P doubled. A R and A P are doubled not of necessity, for the 80 Leagues Difference of Longitude might have been laid on the arch P N, and the distance measured by an arch described on A R; but for conveniency that our line of equal parts might serve without doubling, halving or taking a new line.

Arithmetically.

Arith.	
As A C *the Radius or sine of* 90°	10,0000000
Is to A L *the Cosine of the Latitude* 51° 30'	9,7941496
So is the Difference of Longitude D C 4° *or* 80 *Leagues*	1,9030900
	11,6972396
To the Distance in that Parallel B L 49.8 *Leagues.*	1,6972396

By this Canon was the Table made beginning *Page* 100, of the Vol. of Tables.

By the Gunter.

90°	00'
51	30
38	30

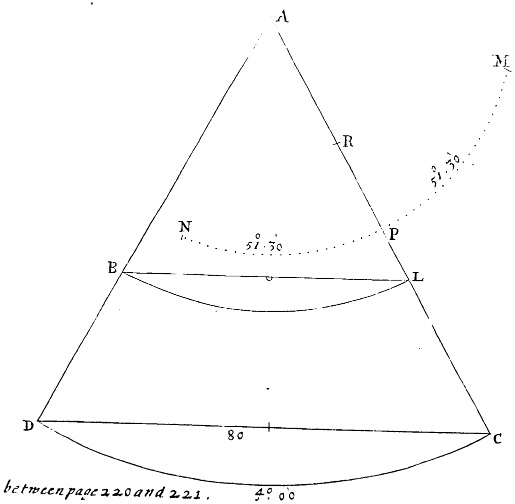
Set one foot on the sine of 90°, and extend the other to the sine of 38° 30': then keeping the same extent set one foot in 80 on the *Line of Numbers*, and turn the other backward and it will fall on 59.8 the Distance.

2. *A Distance in any Parallel of Latitude being given, to find the Difference of Longitude.*

If a Ship Sail 49.8 Leagues East or West in the Latitude 51° 30': what will be the Difference of Longitude?

Geometrically.

Having drawn the Meridian A C, and with 60° of the Chords described the arch N M, and pricked the Latitude from P both ways to N and M, made the mark R, doubled A R, and A P, and described the arches C D, and L B as in the last Proposition: take 49.8 Leagues from the line of equal parts, and prick it from L to B and draw B L and D C. *Geom.*



between page 220 and 221.

Arithmetically.

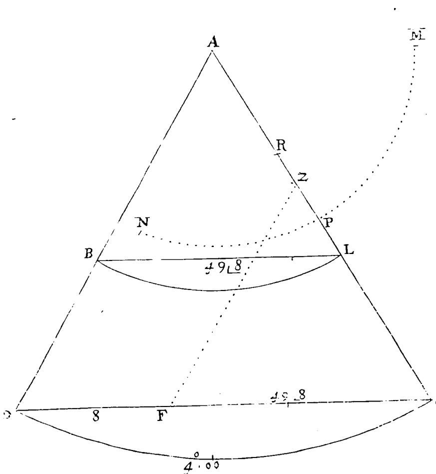
Arith.

80	*As* AL *the Cosine of* 51° 30′ *the Latitude*	9,7941496
3	*Is to* AC *the Radius or sine of* 90°	10,0000000
6|0) 24|0	*So is the Distance Sailed* BL 49.8 *Leagues*	1,6972396
		11,6972396
4.00	*To the Difference of Longitude* DC 80 *Leagues.*	1,9030900

Which turned into degrees is 4° 00′.

By this Canon was made the Tables beginniug *Page* 94, and *Page* 108 of the Volumn of Tables.

By the Gunter. Set one foot in the sine of 38° 30′, and extend the other to the *Radius* or sine of 90°, then keeping that extent set one foot in 49.8 of the *Line of Numbers*, turning the other forward, and it will fall on 80 the Difference of Longitude.



between page 222 and 223. this Sch: belongs to y^e Prop: on the next Page viz: page 223.

3. *The*

3. *The Distance Sailed under any Parallel of Latitude, and the Difference of Longitude being given, to find the Parallel or Latitude.*

If a Ship Sail East or West 49.8 Leagues, and thereby differ her Longitude 4° 00′: what Parallel or Latitude has she Sailed under?

Geometrically.

Geom. Having drawn the Meridian A C, and with 60° of the Chords described the arch N M, and with A C (the double of A P) described the arch D C, and laid 80 Leagues the Difference of Longitude from C to D and drawn D C, A D, prick 49.8 Leagues the Distance, on C D from C to F, and through F draw a Parallel to D A as F Z, then with Z C, as *Radius*, setting one foot of the Compasses in A, with the other describe the arch B L. Lastly, bisect A L with a line at right Angles thereto as N M, then is the arch P N or P M cut off by this line equal to the Latitude.

4° 00′	
20	
80	

Arithmetically.

Arith.

As the part of the Æquinoctial CD, 80 *Leagues, the Difference of Longitude.*	1,9030900
Is to the Semidiameter of the Æquinoctial CA, *the Radius or sine of* 90°.	10,0000000
So is the part of the Parallel LB 49.8 *Leagues the Distance Sailed.*	1,6972396
	11,6972396
To AB *the Semidiameter of the Parallel, which is equal to the Cosine of the Latitude* S: 38° 30′.	9,7941496

By the Gunter.

The Extent of the Compasses, from the Difference of Longitude 80 Leagues to the Distance 50 Leagues, will reach from the sine of 90° to S: 38° 30′ the Complement of the Latitude.

There be several other of this kind, as

Admit two Ships under the Equinoctial 100 Leagues distant asunder, and they Sail both directly North 550 Leagues. How far will they then be asunder?

Two

Two Ships in Latitude 50° 40′ North distant 50 Leagues one from the other, they Sail both directly North 700 Leagues: how far shall they then be Distant asunder, *&c?*

SECTION V.

To make a MERCATORS Chart.

THE *Chart* may be made either General for the whole World, or Particular, for some certain part thereof.

He that understands the making of the one cannot be ignorant how to proceed for the other, therefore I shall only shew

To describe a Particular Chart, for some certain Number of Degrees of Longitude, and Latitude more or less according as a Voyage shall require.

Let it be required to graduate a Chart for a Voyage, between the Parallels of 44° and 50° of North Latitude, and to contain 6° of Longitude.

First, Draw the North and South Line A B, and cross it at right Angles in the point A, with another right line A D, representing the Parallel of 44°.

Then taking 1 or 10 from any line of equal parts or Diagonal Scale, prick it on A D six times from A to D for the 6° of Longitude, marking them 1, 2, 3, *&c.* As in the Draft, subdividing each of these Degrees into ten equal parts which will be 6′ each, and afterwards through A, draw A B Parallel to D C.

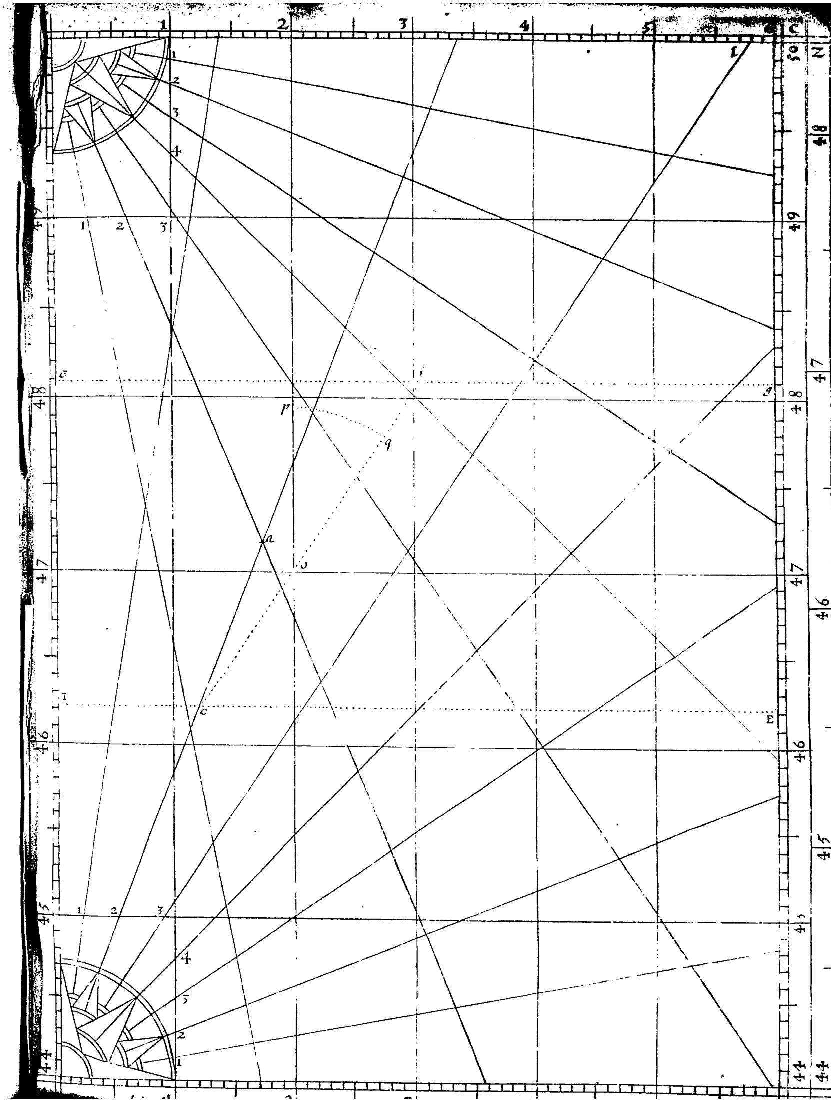
Secondly, Look in the Table of Meridional parts, for the parts answering to both Latitudes,

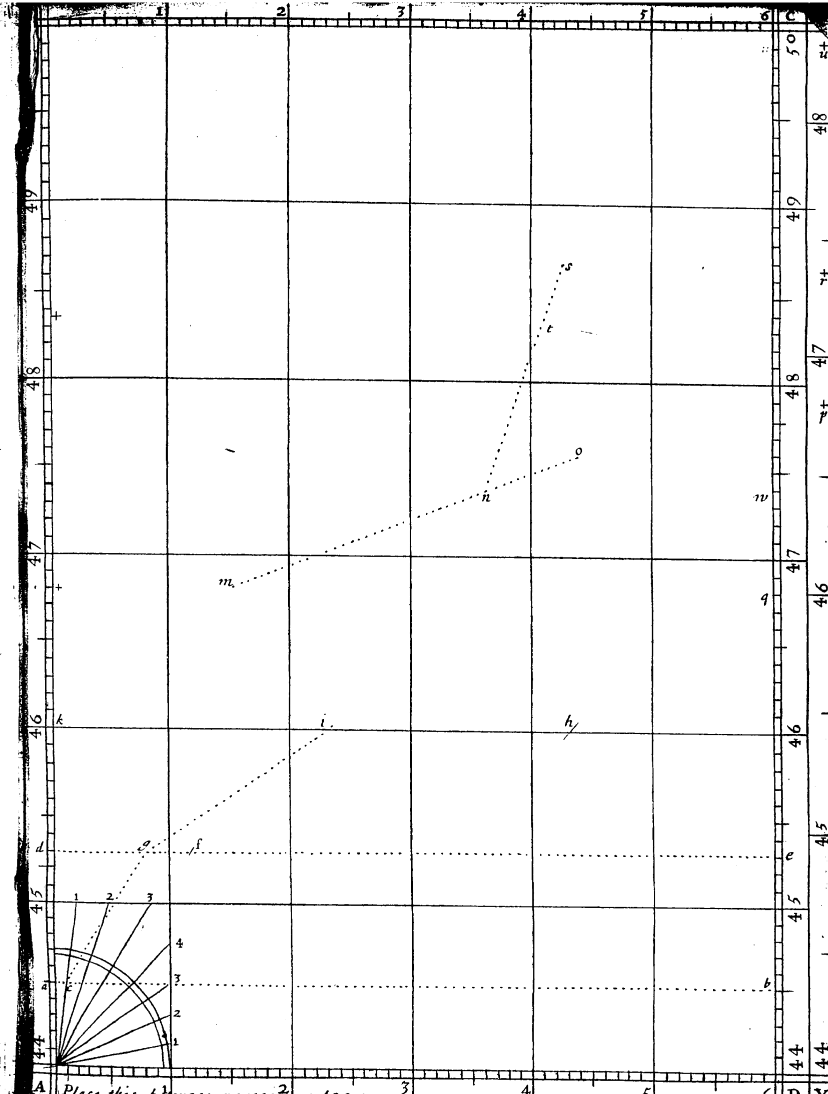
$$\text{Against} \begin{Bmatrix} 50^\circ \\ 44 \end{Bmatrix} \text{are} \begin{Bmatrix} 3474.5 \\ 2945.9 \end{Bmatrix}$$

528.6 the Difference.

The Difference of these Numbers answering to both Latitudes, *viz.* 528.6 Miles, take from the Diagonal Scale and prick on the Meridians from A to B, and from D to C, and draw B C, the Parallel of 50° of Latitude, so are both the extream Meridians and Parallels drawn.

Thirdly,





Place this between page 224 and 225

Thirdly, Through 1, 2, 3, 4, &c. of the Line A D draw Parallels to A B, which will be the Meridians of the *Chart*. Now if you have a *Meridian Line* anſwerable to the equal parts uſed, as there is one on the *Gunters Scale*, it is but transferring the Diviſions thereof to the Meridian A B, either by laying the edge of the Scale that has the Meridian Line graduated on to the Meridian A B, or taking them with the Compaſſes, &c. and through theſe points 45°, 46°, 47°, &c. of the Meridian A B drawing Parallels to A D, and the *Chart* is compleatly graduated.

Elſe taking out of the Table of Meridional parts the Numbers for Latitude 44°, and any other Degree you have a mind to prick down, ſubtract them one from the other, and the Difference taken from the Diagonal Scale lay from A upwards.

$$\text{Thus the parts for} \left\{ \begin{array}{l} 47^\circ \\ 44 \end{array} \right\} \text{ are } \left\{ \begin{array}{r} 32028 \\ \underline{29459} \\ 256.9 \end{array} \right.$$

The Difference 256.9 prick from A to 47°, ſo proceeding for the reſt, even the ſubdiviſions alſo.

If the two extream Latitudes be one South, and the other North, that is not both in one Hemiſphere, then add the Meridional parts of both Latitudes together, and the Sum pricked on the North and South line gives the length of the *Chart*. You may deſcribe a Compaſs in ſome convenient place, and draw the *Rumb-lines* as in the firſt draft.

Laſtly, On the out ſide of D C, make another line of equal parts X Z, whereof each degree may be twice as large as a degree of Longitude, and divide and graduate it as you ſee in the draft, I call this line the *Aſſiſtant*.

Sometimes the line A D muſt be uſed as a line of Leagues, and then will this *Aſſiſtant-line* be of uſe and not elſe.

To lay down a Place, or make a prick on the Chart.

To lay down a Place by the Courſe and Diſtance.

Admit you have Sailed from A, a place in Latitude 44° North, 48 Leagues North North Weſt, and it be required to prick the place the Ship is in.

Take 48 Leagues out of the line of Longitude A D, and enter it on the ſecond *Rumb* or North North Weſt line from A to *a*, the neareſt diſtance from *a* to A D prick in the *Aſſiſtant-line* from X to *b*, and it ſhews that the Ship is arrived at the end of 48 Leagues Sail in Latitude 46° 14′ to which Latitude looked on the Meridian A B, ſet the Letter I.

Secondly, Through the point I, draw the Parallel of Latitude I E, and where that cuts the *Rumb-line* as at C is the place the Ship is in.

To lay down a Place by its Latitude and Longitude.

Draw a Meridian-line at the given Longitude of the Place, and a Parallel of Latitude at the Latitude given, and the point where this Meridian and Parallel cut one the other is the Prick representing the Place.

By the Course and Latitude to lay down a Place, or make a Prick.

Admit from C a place in Latitude 46° 14′, I Sail North West by North 'till I am in Latitude 48° 6′, and would prick the Place of the Ship.

At 48° 6′ of the Meridian-line, I draw the Parallel of Latitude *e g*, and through C, I draw a Parallel to the North West by North *Rumb-line* as *c i*, and where that cuts the Parallel *e g*, as at *i* is the Ships Place.

What has been done thus by drawing lines, may be performed by the intersection of two small arches or lines, and a Ruler, without drawing long lines through the *Chart*: for a Ruler will supply lines without drawing them.

To find the Latitude, Longitude, Course and Distance between any two Places already laid down in the Chart.

To find the Latitude.

Take with the Compasses the nearest distance, between the given Place *c*, and some Parallel of Latitude as A D: then setting one foot of the Compasses on the end of that Parallel as at A, apply that extent to the graduated Meridian, the right way, (*viz.* that way that the Place lyeth from the Parallel) and the other foot will shew at I, the Latitude of the Place.

To measure the Longitude or rather Difference of Longitude.

Take with the Compasses the nearest distance, between the given Place *c*, and some Meridian as A B: then setting one foot on the end of that Meridian A, apply that extent to the graduated Parallel, and the other foot will shew the Difference of Longitude, that the place *c* is from that Meridian A B.

To find the Course between any two Places in the Chart.

Lay a Ruler over the two Places as *c i*, see what *Rumb-line* runs Parallel thereto as A *l*, and that shews the Course. But if the *Rumb-lines* be not drawn, take 60° from the Chords, and setting one foot in *o* where the Ruler cuts some Meridian, describe the obscure arch *p q*, which measured

measured on the line of *Rumbs* on the Scale, shews the Course 3 Points from the Meridian, *viz.* North West by North.

To measure the Distance between two Places.

If the two Places differ only in Latitude, the Difference of Latitude is the distance between them.

If the two Places are both in the same Latitude, take the distance between them, and apply the Compasses to the graduated Meridian, one foot standing as much above the Latitude as the other below, the degrees intercepted is the distance, or rather thus:

Take a degree of the Meridian-line at that Latitude, and turn it between the two Places by a strait-line, and so often as you shall find that length between the two Places, so many score Leagues is the distance between them.

If two Places differ both in Latitude and Longitude, take their Difference of Latitude in degrees from the line A D, and laying a Ruler upon the two Places, apply one point of the Compasses so to the edge of the Ruler, that the other turned about may just touch some East and West-line crossed by the Ruler, then take the distance by the edge of the Ruler, from the Place where the Compasses rested, to the Place where the Ruler crosses the said East and West-line, that extent measured on the line A D, shews the degrees or scores of Leagues between the two Places.

To keep a Mercator-account of the Ships Place daily by the observed Latitude, and the Course.

Admit a Ship Sail from A, a Place in Latitude North 44° 00′, North by West till she's arrived in the Latitude 44° 30′, and from thence North West by North 'till in the Latitude 45° 18′, and afterwards North West by West 'till she fall in Latitude 46°: what is the Difference of Longitude, and also the Course and distance made good from the first Place of Departure?

First, Draw the Parallel of 44° 30′ Latitude, and where it cuts the North by West, or first *Rumb-line* from the Meridian as at *c* is her place on that *Rumb*. Then draw the Parallel of 45° 18′ of Latitude *d e*, and continue the North West by North or third *Rumb-line* 'till it cuts it in *f*: then through *c* draw a Parallel to the *Rumb-line* A *f* as *c g*, the point *g* where it cuts the Parallel of Latitude, is the place of the Ship at the end of her North West by North Course.

Thirdly, Draw the Parallel of 46 of Latitude, and continue the North West by West *Rumb-line* 'till it cut it in *h*, and through *g* draw a Parallel to A *h* as *g i*, so is *i* her place at last. Now taking *i k*, and applying it to A D you'l find she's 2° 20′ Longitude West from A, and by laying a Ruler over A and *i*, you will find by comparing it with the *Rumb-lines*, she

ſhe has made a North Weſt by North Courſe half a point and better Weſterly.

Arithmetically.

Arith. It may be performed by the third Caſe, or Propoſition of *Mercators* Sailing.

This way of keeping an account of a Voyage, is not contemptible, in parts where there's a certainty of a clear Heaven to obſerve in, ſo that care be taken ſtill to rectify the Compaſs, keep her ſteer ſteady, Lee-way allowed for, and the Currents tryed once a day, all which trouble is pretty well recompenced in the omitting the continual keeping an account of the Diſtance.

But it's objected that becauſe there is no way of examining, or diſcovering whether any error be in the account or not, unleſs ſome ſmall glimpſe from the Variation, and if diſcovered yet here's no way of correcting it, until ſome way be found for obſerving the Longitude (after which this will be the beſt and only way) it's not a ſafe method to rely on.

To which I anſwer, that if an account of the Ships way be kept, alſo the correction may be made by that, but then it will be better to keep the whole account by her courſe and diſtance, and correct by the obſerved Latitude like as in Plain Sailing, and as follows.

To keep a true account of the Ships place daily, by her Courſe and Diſtance.

Suppoſe a Ship Sail from A in North Latitude 44° 00′, North North Weſt 60 Leagues or 180 Miles, then Weſt North Weſt 30 Leagues or 90 Miles, afterwards North by Weſt half a point Weſterly 20 Leagues or 60 Miles: what's the Latitude ſhe's in, the Difference of Longitude, Courſe and Diſtance ſhe has made good?

Geometrically.

Geom. Taking 60 Leagues from the line AD prick them on the North North Weſt line from A to *m*, and taking the neareſt diſtance to AD, and applying it to the line XZ you will ſee ſhe's in Latitude 46° 48′: then drawing the Parallel of Latitude 46° 48′, and producing the North North Weſt line, they will meet in *m* the firſt point.

Secondly, Through *m* draw a Parallel to the Weſt North Weſt line, as *mn*, and lay thereon 30 Leagues from *m* to *o*, and taking the neareſt diſtance from *o* to the Parallel of 46° 48′ Latitude *mq*, ſet it on the *Aſſiſtant-line* from *p* to *r* which ſhews you are now in Latitude 47° 22′, and drawing the Parallel of 42° 22′ Latitude where it cuts *mo*, as at *n*, is her place on the *Chart*, at the end of the ſecond Courſe.

Thirdly,

between page 248 and 249.

Thirdly, Through *n* draw a parallel to the North by West ½ Westerly *Rumb-line*, and prick thereon 20 Leagues from *n* to *s*, and taking the nearest distance from *s* to *nw* the Parallel of 42° 22′ Latitude, apply it to the *Assistant-line* from *r* to *u*, which shews the Latitude now to be 48° 20′.

Lastly, Draw the Parallel of 48° 20′, and where it cuts *ns* as at *t* is the Ships place at the end of this third Course. Thus must they be proceeded with if more. Now find the Longitude of the point *t* by the former directions, and also the Course and Distance made good from A.

By the Tables Page 59, *and* 108, *of the* Volumn *of* TABLES.

Arithmetically.

Courses	*Points.*	*Dist.*		*Depar.*		*Alter. of Latitude.*		*Lat. the Ship is in.*		*Diff. of Longitude.*		
○		M	P	M	P	M	P	°	′	°	′	″
	0	0	00	0	0	00	00	44	00	0		0
North North West	2	100		38	26	92	38			1	26	22
		80		30	61	73	91			0	12	57
		180		68	87	166	29	46	46	1	39	19
West North West	6	90		83	14	34	44	47	20	1	57	18
										0	4	24
North by West ½ Wly.										[illegible]	01	4
	1½	60		14	57	57	41	48	18	0	14	57
										0	7	28
										0	22	25
									The Difference of Longitude.	4	03	26

Having drawn several Columns, and entred therein the Courses and Distances, Departures and Alterations as directed before in a *Plain Chart Traverse*, and as you see in this specimen, by adding or subtracting the Northings or Southings according as the Latitude increaseth or diminisheth, find the several Latitudes putting them in another Column.

Then

Then ènter the Table (beginning *Page* 108 of the *Voll.* of Tables) with the reſpective Latitude in the Left Column, and the Departure on the head, and the Degrees, Minutes, and Seconds thence taken put in the Column under Difference of Longitude.

Laſtly, Collect all the Eaſt differences into one ſum, and the Weſt differences into another, then ſubſtract theſe ſums the one from the other, and the Remainder is the Difference of Longitude in Degrees, Minutes and Seconds.

Note that when you cannot find the whole Departure at once, you muſt take it out at twice or thrice, as you was directed to do with the diſtances in the *Plain Chart Traverſe.*

Thus, looking 46° Latitude in the Left Column of the Table, and 60 (the Articular part of the Departure 68 *miles* 87 *parts*) on the head, in the Angle of meeting I find 1° 26′ 22″, and under (8 *m.* 87 *par.* or inſtead thereof) 9 *m.* is 0° 12′ 57″, the ſum of theſe two makes 1° 39′ 19″ the Difference of Longitude made in the firſt Courſe. Then looking 47° of Latitude in the left Column, and 80 on the head of the Table, I take out 1° 57′ 18″, and under three miles and againſt 47° Latitude I find 0° 4′ 24″, their ſum 2° 1′ 42″ is the Difference of Longitude in the ſecond Courſe.

Afterwards looking 48° Latitude in the left Column and 10 *m.* on the head of the Table I find 0° 14′ 57″, and under 5 (which I take inſtead of 4 *m.* 57 *par.*) againſt 48° Latitude I find 0° 7′ 28″, the ſum 0° 22′ 25″ is the Difference of Longitude in the third Courſe. And thus muſt I have proceeded if there had been more Courſes.

Now ſeeing my Differences are all of one name, *viz.* all Weſt, I add them all together, and the ſum 4° 03′ 26″ is the whole Difference of Longitude made in this *Traverſe.*

A ſecond Example.

Admit a Ship Sail from Latitude 53° North, firſt South South Weſt 12 Miles, then South Weſt by South 17 Miles, South Weſt 23 Miles, Weſt South Weſt 18 Miles, and Weſt 15 Miles: afterwards South by Eaſt 8 Miles, South Eaſt by South 27 Miles, Eaſt by South 30 Miles, and Eaſt 19 Miles. The Difference of Longitude, Courſe and Diſtance is required.

Courſes

Courſes	*Points.*	*Diſt.*		*Depar.*		*Alter. of Latitude.*		*Lat. the Ship is in.*		*Diff. of Longitude.*		
		M	P	M	P	M	P	°	′	°	′	″
		0	0	0	0	0	0	53	00	0	0	0
South South Weſt	2	12		4	59	11	09					
								52	49	0	7	37
South Weſt by South	3	17		9	44	14	13					
								52	35	0	15	30
South Weſt	4	23		16	26	16	26			0	16	14
										0	10	30
								52	19	0	26	34
Weſt South Weſt	6	18		16	63	6	87			0	16	14
										0	10	35
								52	12	0	27	11
Weſt	8	15		15	00	00	00			0	16	14
										0	8	07
								52	12	0	24	31
South by Eaſt	1	8		1	56	07	85			0	02	30
								52	04			
South Eaſt by South	3	27		15	15	22	45			0	16	14
										0	8	22
								51	42	0	24	36
Eaſt by South	7	30		29	42	5	85			0	31	47
										0	15	00
								51	36	0	46	47
Eaſt	8	19		19	00	00	00			0	16	03
										0	14	15
								51	36	0	30	18

Courſes	°	′	″	
6	0	02	30	
7	0	24	36	
8	0	46	47	
9	0	30	18	
	1	44	11	*Eaſt Long.*

Courſes	°	′	″	
1	0	7	37	
2	0	15	30	
3	0	26	34	
4	0	27	11	
5	0	24	31	
	1	41	23	*Weſt Long.*

Having

Having made ſeveral Columns and Tabulized the Courſes and Diſtances as before, and by making Entries therewith in the firſt *Traverſe Table*, beginning *Page* 59 of the Tables, found the Alterations of Latitude and Departures, and by adding or ſubtracting found the Latitudes all as in the laſt *Example*, then enter the Table *Page* 108 with the Departure and Latitude, and take out the Differences of Longitude as in the firſt *Example*.

But ſome think it enough once a week to transfer their account to the *True Chart*, keeping it daily by the *Plain Chart*, ſuch may take their whole weekly Eaſting or Weſting, and their middle Latitude, and by entring the Table *Page* 108 readily take out their Longitude.

Of Currents and how to allow for them in your account.

If a Current ſet directly againſt a Ship in her Courſe, it leſſens her Diſtance Sailed by ſo much as is the drift or race of the Current in the ſame time

If a Current run direct with the Courſe a Ship Sails, it will augment her Diſtance, by ſo much as is the drift of the Current in the ſame time.

If a Current thwart the Ships Courſe, it not only augments or diminiſheth her diſtance but makes her err in her Courſe, ſo that without knowing where they are (which I ſhall at the end of this part ſhew how to find) and when found take care to prevent the errors that would proceed from them, by allowing for them in the Reckoning, you may in Sailing to ſome ſmall lone *Iſland*, be at ſuch a loſs, that you may not know which way to Steer, as it has happened to ſeveral. To avoid this it is uſual now not to make directly for ſuch *Iſlands*: but to get into the Latitude thereof while they are certain whether they be to the Eaſt or Weſt of it; and then keep in that Latitude Sailing directly Eaſt or Weſt according as the Place lieth, diligently looking out for it till they get ſight thereof.

But in long Voyages, where there can be no ſuch groping for Land every few days without quite ſpoiling their Voyage, yet muſt croſs many Currents and keep a continued account for many weeks together, there muſt be skill to allow for the Current upon any *Rumb* whatever, ſo that by Obſervation of your Latitude, you might have by computation your true Longitude.

Admit

Admit a Ship ſail from Latitude 40° 00′ North, 36 hours: firſt North Eaſt 48 miles, then North by Eaſt 57 Miles, in a Current that ſets directly towards the North, one mile an hour; what Latitude is ſhe arrived in, and what Diſtance and Difference of Longitude has ſhe made?

Hours.	Courſes.	Points.	Diſt.		Depar.		Alter. of Latitude.		Lat. the Ships in.		Difference of Longitude.		
	0		M	P	M	P	M	P	°	′	°	′	″
		0	0	0	0	0	0	0	40	00	0		0
20	North Eaſt	4	48	0	33	04	33	04			0	39	46
	The Current,				0	00	20	00			0	03	57
					33	04	53	04	40	53	0	43	43
16	North by Eaſt	1	57	0	11	12	55	90			0	13	21
	Current.				0	00	16	00			0	01	20
					11	12	71	90	42	05	0	14	41
											0	58	24

Without regard to the Current, the Ship ſhould be at the end of her firſt Courſe in Latitude 40° 33′, to which add 20 miles for the drift of the Current, and the ſum is 40° 53′, the true Latitude, with which and the departure 33 *m.* 04 *p.* enter the Table page 108, and you will find the difference of Longitude thereto 0° 43′ 43″.

Again at the end of the ſecond Courſe ſhe ſhould be, without regard to the Current, in Latitude 41° 4[illegible]′, but adding thereto the drift of the Current in 16 hours, *viz.* 16′, the ſum 42° 05′ is the true Latitude ſhe's in, with which and the departure 11 *m.* 12 *p.* enter the ſaid Table again and you will find the difference of Longitude anſwering thereto 0°. 14′. 41″, which added to 0° 43′ 43″, makes 0° 58′ 24″ the true difference of Longitude made in this 36 hours ſail, the Current allowed; but without allowing for the Current ſhe had been but in 41° 29′ of Latitude, and had made but 0° 58′ 00″ difference of Longitude: and if the Current had been allowed yet the account kept by the *Plain Chart*, ſhe would have been nevertheleſs in Latitude 42° 05′, but her difference of Longitude would have been but 44′. If the Current had ſet directly South you muſt have ſubtracted the drift of the Current from the differences of Latitude, if it had ſet Eaſt the drift thereof muſt have been added to the Departure, becauſe ſhe makes Eaſt Departure, &c.

Admit between *July* the 27*th* at noon, and noon the 29*th*, a Ship ſail from Latitude 45° 00′ North, firſt 6 hours North 27 minutes or miles,

secondly 7 hours North North East 35 miles or minutes, ten hours West North West 48 miles, afterwards 9 hours West by North 50 miles, then again ten hours North West 53 miles, and lastly six hours West 38 miles, crossing a Current that sets North East half a knot, a small gale, smooth water, and little or no Variation; what is the true Course and Distance, and difference of Longitude she has made, and the Latitude she is now in?

Hours.	*Courses.*	*Points.*	*Dist.*		*Depar.*		*Alter. of Lat.*		*Lat. the Ship is in.*		*Diff. of Longitude.*		
	0		M	P	M	P	M	P	°	'	°	'	"
		0	00	00	00	00	00	00	45	00	0	00	00
6	North *Current.*	0 4	27 3	0 0	00 02	00 12	27 02	00 12					
					02	12	29	12	45	29	0	03	02
7	North North East *Current.*	2 4	35 3	0 5	13 02	39 48	32 02	34 48			0 0	14 08	24 28
					15	87	34	82	46	04	0	22	52
10	West North West *Current.*	6 4	48 5	0 0	44 03	35 54	18 03	37 54			0 0	58 01	06 11
					40	81	21	91	46	26	0	59	17
9	West by North *Current.*	7 4	50 4	0 5	49 03	04 19	09 03	75 19			0 0	58 08	16 33
					45	85	11	94	46	39	1	06	49
10	North West *Current.*	4 4	53 5	0 0	37 03	48 54	37 03	48 54			0 0	44 05	16 49
					33	94	41	02	47	20	0	50	05
6	West *Current.*	8 4	38 3	0 0	38 02	00 12	00 02	00 12			0 0	44 08	10 43
					35	88	02	12	47	2[illegible]	0	52	53
									West Long.		3	49	03
									East Long.		0	25	54
							Diff. Long. West.				3	23	09

With these two Latitudes 45° 00', 47° 22', and the Difference of Longitude 3° 23' 09", by the first Case of *Mercator's* sailing, find the Course and Distance.

Suppose

Suppose a Ship sail in 48 hours from Latitude 45° 00' North, first 6 hours North by East 27 miles or minutes, secondly 7 hours North East by North 35 miles, 10 hours North West by West 48 miles, afterwards 9 hours West North West 50 miles, then again 10 hours North West by North 53 miles, and lastly 6 hours West by North 38 miles, the Compass Varying 1 Point from the North Eastward, and crossing a Current that sets North East by East half a knot, a small gale and smooth water; what is the true Course and Distance and Difference of Longitude she has made, and the Latitude she is now in?

Courses.	*Hours.*	*Courses correct by the Variation.*	*Points.*	*Dist.*		*Depar.*		*Alter. of Lati.*		*Lat. the Ships in.*		*Diff. of Longitude.*		
				M	P	M	P	M	P	°	'	°	'	"
			0	00	00	00	00	00	00	45	00	0	00	00
N by E *Cur.* N E by E.	6	North North East.	0 4	27 3	00 0	00 02	0 12	27 2	0 12					
						02	12	29	12	45	29	0	03	02
N E by N *Cur.* N E by E.	7	N N E North East.	2 4	35 3	0 5	13 02	39 48	32 02	34 48			0 0	14 8	24 2[illegible]
						15	8[illegible]	34	82	46	04	0	22	52
N W by W *Cur.* N E by E.	10	W N W North East.	6 4	48 5	0 0	44 03	35 54	18 3	37 94					
						40	89	21	91	46	26	0	59	17
W N W *Cur.* N E by E.	9	West by North North East.	7 4	50 4	0 5	49 3	4 19	09 03	75 19			0 0	58 08	16 33
						44	85	12	94	46	39	1	06	49
N W by N *Cur.* N E by E.	10	North West North East.	4 4	52 5	0 0	37 3	48 5[illegible]	37 3	48 54			0 0	44 05	16 49
						33	94	41	02	47	20	0	50	5
W by N *Cur.* N E by E.	6	West North East.	8 4	38 3	0 0	38 2	0 12	00 02	0 12			0 0	44 08	10 43
						35	88	02	12	47	22	0	52	53
										West Long.		3°	49'	03"
										East Long.		0	25	54
								Diff. of Long. West.				3	23	09

If she had made any Lee-way, it ought to be allowed on each single Course, just as the Variation is here.

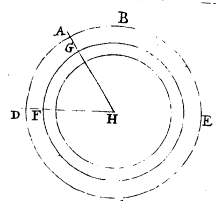
some

Some think it well enough to keep their daily account according to the *Plain Chart*, and to transfer it to the *True Chart* once a week: such may take their whole weeks Easting or Westing and their middle Latitude, and by entring therewith the said Table page 108, readily take out their Longitude.

Section VI.
Of Observation and the use of Instruments.

CElestial Observation is founded on these two principles.

1. That when many Circles are Concentrick, the lines drawn from the Center to the circumference divide them all in the same manner, as in *Examples* If the Circles *DBE*, *FGR* be described from the same center *H*, and the lines *HFD*, *HGA* drawn, the Arches *DA*, *FG* shall be like Parts of the Circumferences, and contain a like number of Degrees.

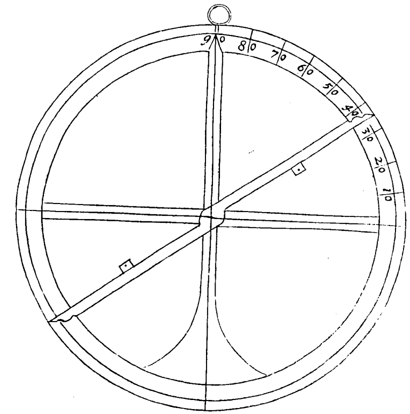


2. That the Terraqueous Globe or Mass of Earth and Water we live on, compared with the Sphere of the Sun (or rather Earths orbit) is of no sensible quantity, but only as a prick or meer point in respect thereof, and consequently that any point on the Earths surface may very well be accepted for its Center, as also for that of the Heavens; therefore is the Center of every Instrument substituted Center of the Heavens.

This being supposed, I say, that a Circle divided into 360 equal Parts or Degrees, is the first and most natural Instrument of all others, and is commonly called an Astrolabe; but is not always the most convenientest for the Navigators use, because of the instability of the Ship, yet it's in calm weather and between the *Tropick* where the Sun comes near the *Zenith*, no contemptible Instrument, is made and poised as they ought to be, and as I have seen some.

The

The Figure of the Astrolabe.



The Description and use of the Fore-staff or Cross-staff.

The Fore-staff consists of a strait square graduated staff, and four Crosses or Vanes, (as the figure A,) the first and shortest is called the *Ten-cross or Vane*, and belongs to that side of the staff, where the Divisions begin at about three Degrees proceeding towards the eye (or flat) end to 10 Degrees, sometimes the *Thirty Cross* is so made, as that the breadth thereof serves instead of this Ten Cross.

The next longer is called the *Thirty Cross or Vane*, and belongs to that side of the staff where the Divisions begin at 10 Degrees, and end at 30 Degrees, and this is called the thirty side: half the length of the *Thirty Vane* will reach on this *Thirty side* from 30 Degrees to 23° 52', and the whole length from 30 Degrees to 19° 47'.

The

The Figure of the Crofs-Staff.

The

The next longer is called the fixty Crofs or Vane, and belongs to that fide where the divifions begin at 20 Degrees and end at 60°, and is called the 60 *fide*. The length of this Crofs will reach on this *fixty fide* from 60 Degrees to 30 Degrees.

The longeft Crofs is called the *ninety Crofs*, and belongs to that fide where the divifions begins at 30 and end at 90, and is called the *ninety fide* of the Staff: fometimes the feveral fides of the Staff are numbred alfo with their Complements to 90 in fmall figures.

The ufe of the Foreftaff.

The chief ufe is either to take the Altitude of the Sun or Stars, or the diftance of two Stars, and the 10, 30, 60 and 90 Croffes are to be ufed according as the Altitude or Diftance is greater or leffer, that is, if it be lefs than 10 Degrees ufe the *Ten Crofs*, if above ten but lefs than thirty, the thirty Crofs and if above 30 but lefs than fixty Degrees, ufe the *fixty Crofs*, above which this is not fo convenient for ufe as other Inftruments.

To Obferve an Altitude.

Place the flat end of the Staff to the out fide of your eye as neer the eye as you can, not to hinder your fight, and look at the upper end of the Crofs for the Center of the Sun or Star, and at the lower end for the *Horizon*, if you fee the sky inftead of the *Horizon*, draw the Crofs a little nearer to your eye, but if you fee the Sea inftead of the *Horizon*, put the Crofs a little farther from your eye, and fo continue moving and removing the *Crofs*, 'till you fee exactly the Sun or Stars Center by the *top of the Crofs*, and the *Horizon* by the lower end thereof. The Degrees and minutes cut by the inner edge of the Crofs, upon the fide of the Staff peculiar to the Crofs you ufe, is the prefent Altitude of the Sun or Star: but if it be the Meridian or greateft Altitude which you are to find, you muft continue your Obfervation as long as you find the Altitude increafe, ftill drawing the *Crofs* nearer to your eye, but when you perceive the Altitude is diminifhed, which you will eafily difcover by feeing at the repeating of the Obfervation, the Sea inftead of the *Horizon*, forbear any farther Obfervation, and do not alter your Crofs, but as the *Crofs* ftands, count the Degree and Minute on the fide proper to the Crofs, which gives the *Meridian Altitude* required, and the *Meridian Altitude* fubtracted from 90 gives the *Zenith Diftance*, if it be not graduated on the Staff. *Fig. B.*

To

To which *Zenith* diftance add the minutes allowed for the height of your eye above the furface of the Sea, according to the little Table in the Margin, or fubtract it from the Altitude, fo have you the true *Zenith* diftance and Altitude.

Height of the Eye.	Allowance.
Feet.	Min.
1	1
2	1½
3	2
4	2
5	2½
6	3
7	3
8	3
9	3½
10	3½
12	4
16	4½
20	5
24	5½
28	6
32	6½
36	7
40	7
44	7½
48	8

If it be hazy or fomewhat thick weather the *Fore-ftaff* may be ufed as above, but if the Sun fhine out they either obferve the upper limb of the Sun, and afterwards fubtract the Suns Semidiameter from the Altitude, or elfe ufe a coloured Glafs on the top of the Crofs to defend the fight from the fplendour of the Sun.

To obferve the diftance of two Stars, or the Moons diftance from a Star, place the Staffs flat end to the Eye as before directed, and looking to both ends of the Crofs draw it nearer or remove it farther from the Eye as you fhall find occafion, 'till you can fee the two Stars the one on the one end, and the other on the other end of the Crofs, then look what Degrees and Minutes are cut by the Crofs on the fide of the Staff proper to that Vane in ufe, and that is the true diftance of the two Stars obferved.

But that there may be no miftake in the placing the Staff to the Eye, which is the greateft difficulty in the ufe of this Inftrument, firft before obfervation put on the fixty Crofs, and place it to 30 Degrees on its proper fide, and alfo the ninety Crofs fliding it to 30 Degrees likewife on his right fide; then place the end of the Staff to the corner of your Eye as directed, moving it fomewhat higher or lower about the Eye, 'till you fee the upper ends of the two Croffes at once exactly in one line, and alfo their lower and that is the true place of your Staff in time of Obfervation.

Some ufe this *Crofs-ftaff* backward in taking the Suns Meridian Altitude, thus.

To make a backward Obfervation of the Suns Altitude with the *Crofs-ftaff*.

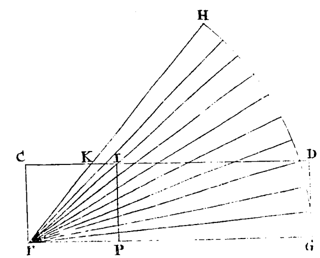
You muft have an Horizontal Vane to fix upon the Center or eye end of your Staff, alfo a fhoe of brafs to fit on to the end of any of the Croffes, which is inftead of a fight Vane. Then, when you would obferve, having put on the Horizon Vane, and fixt the fhoe to the end of a Convenient Crofs, turn your back to the Sun, and looking through the fight in the brafs fhoe, lift up or down the end of the Staff, till the fhaddow made by the upper end of the Crofs, fall upon the flit in the Horizon Vane, and at the fame time you can fee the Horizon through the Horizon Vane; then the Degree and Minute cut by the Crofs on the proper fide is the Altitude,

Altitude, but if their be fixt a lens or fmall double convex glafs, to the upper end of the Vane to contract the fun beams, and caft a fmall bright fpot on the *Horizon* Vane; poffibly it may be found more convenient than the fhadow, for as much as that is commonly imperfect and double.

How to make the Fore-ftaff.

It may be graduated either Arithmetically by the Table of Natural Tangents, or Geometrically from the divifion of a quarter of a Circle.

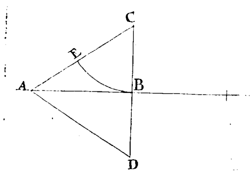
To Graduate it Geometrically.



Upon a Table, or on a large Paper fmooth pafted on fome plane, draw the line F G of the length of the Staff to be graduated, and on F and G raife the Perpendiculars F C, G D, laying thereon the length you intend for the half length of the Crofs, from F to C, and from G to D, and draw C D reprefenting the Staff to be graduated. Then on the Center F defcribe your Arch G H being the half quarter or an eight part of the Circle, and divide it into 90 equal parts or degrees, thus; Firft divide it into three equal parts, and each of thefe again into three, thefe parts each into two, and each of the laft parts into five. Thirdly from F draw ftrait lines through each of thefe points 10, 20, 30, &c. Which fhall divide the line C D as the Staff ought to be graduated.

In graduating the Staff by the Table of Tangents.

Note that the graduations are only the Natural Co-tangents of half Arches, the half Crofs being *Radius*: Therefore divide the length of your half Crofs into 1000 or rather 100000 equal parts if it may be, according to the *Radius* of the Tables of Natural Tangents, then take from this the Co-tangents as you find them in the Table, and prick them from F orderly and your Staff will be exactly graduated for that Vane, fo do for the reft feverally. If it be required to prick the eightieth degree, the half of 80 is 40, and the Natural Co-tangent of 40° is 119175, which take from the Scale or half Crofs fo divided, and prick it from F to P where fhall be the point for 80°, *&c.* So again to put on the 64*th* degree, the half of 64 is 32, and its Co-tangent 160033 which take from the divided Crofs (prolonged) prick it from F, and it will give you the 64 degree.



Now that the Crofs C D when transferred to B, fhall make the Angle C A D eighty degrees, is demonftrable thus.

Seeing C B the half Crofs is *Radius*, and A B is by conftruction the Tangent of 50° the Angle A C B is 50°, and feeing the Triangle A B C is right angled, the Angle B A C will be 40 degrees, *viz.* the Complement of 50°: But D A C is the double of B A C, therefore the Angle D A C is 80, and the point B the true point on the Staff for 80 degrees. The fame manner of Demonftration holds let the Crofs be what it will.

To Graduate the Staff by any Diagonal Scale.

Meafure the half length of your Vane by the Scale, and fay as the *Radius* of the Tables 1000000 is to the meafure of the half Crofs, fo is the Natural Co-tangent of the half of any degree defired to be pricked on the Staff, to the fpace between the Center of the Staff F, and the point for the Degree.

Admit

Admit the half Vane meafure on the Diagonal be 945, to find what Number muft be taken off the Dioganal for the eightieth Degree. The Co-tangent of 40° (the half of 80) is 11917536, which multiplyed by 945 makes 11261, *&c.* which taken from the Diagonal Scale will prick the degree defired.

A Vane or Crofs being loft to find of what length it was.

If it be the *ninety Crofs*, the diftance of the 90° from the Center, or eye-end of the Staff is the half length of the Crofs.

If it be the thirty Crofs that's loft, fay,

As the Co-tangent of 15°.

Is to the diftance of 30, *from the Center or eye-end of the Staff:*

So is the Radius, to the half length of the Crofs.

If the tenth Crofs be wanting, *fay,*

As the Co-tangent of 5 *degrees* (viz, *the half of ten,*)

Is to the fpace between 10 degr. *and the eye-end of the Staff:*

So is the Radius,

To the half length of the Crofs.

The Defcription and ufe of the Demi-Crofs.

This Inftrument is fometimes ufed by the *Dutch*, but has been wholly neglected by the *Englifh*, we prefering the whole Crofs or Foreftaff.

This Staff is eafily graduated it being only a line of whole Tangents, whofe *Radius* is the length of the Crofs or Tranfum. A is the Horizon Vane, H the fight Vane, and E the fhade Vane.

To take the Suns Altitude with it.

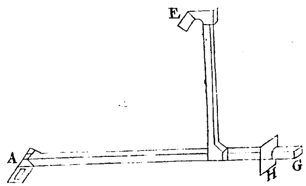
Having put the Vanes on their proper ends, hold up the Inftrument with the Tranfum as upright as you can, and looking through the fight Vane H, fee for the *Horizon* through the flit in the *Horizon* Vane, fliding the Crofs or Tranfum to and fro, till you fee the fhade of the Vane E fall at the fame time upon the flit of the *Horizon* Vane A. Then are the Degrees cut on the Staff by the Tranfum the Altitude of the Sun required.

To obferve the height of a Star with it.

Remove the *Horizon* Vane A, and put it on the end G, and transfer the fight Vane H to A, then holding up the Inftrument with the Tranfum upright, and looking through the fight Vane, fee for the *Horizon* through the *Horizon* Vane, and for the ftar by the fhade Vane, fliding the Tranfum to and fro till the *Horizon* and Star are both feen by their refpective Vanes, then will the Tranfum cut the degrees of Altitude, allowing for your height above the level of the *Horizon* or Sea.

The

The Figure of the Demi-Croſs.

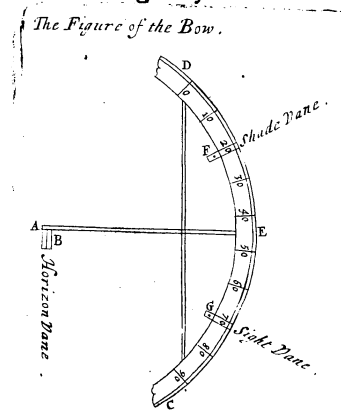


The Deſcription and uſe of the Bow.

This Inſtrument conſiſts of only one large Arch of 90° well and truly graduated, three Vanes and a ſhank or ſtaff, as you ſee in the Figure, where D E C is the Arch, A E the ſtaff or ſhank, paſſing the Arch at 45 in moſt, but in ſome in 50 or 55°, F is the ſhade Vane, G the ſight Vane, and A B the Horizon Vane placed on the very center of the Arch; the manner of making it is conſpicuous enough from the diſcription and figure. Its chief uſe is to take the Suns height, which is done thus, take the handle C in your hand, and holding the Bow as upright as you can, move the ſight Vane up and down ſtill looking through the ſight, 'till you ſee the ſhade of the upper part of the ſhade Vane, on the ſlit of the Horizon Vane, and at the ſame time you ſee alſo the Horizon through the ſlit of the Horizon Vane, in doing which if you ſee the Sky and not the Horizon, then draw the ſight Vane a little lower down towards C, but if you ſee the Sea inſtead of the Horizon then ſlide it upwards. If it be the Meridian Altitude that is to be obſerved: then you muſt wait, and make obſervation as often as you judg fit, 'till you ſee at repeating the obſervation the Sea inſtead of the Horizon before you deſiſt; the difference between the degrees and minutes cut by the ſight Vane, and theſe cut by the upper part of the ſhade Vane, is the diſtance of the Suns upper limb from the Horizon, from which if you ſubtract 16' which is the Suns Semidiameter, the Remainder will be the diſtance of the Suns Center from the Horizon, from which if you ſubtract the Refraction as you find it, *page* 257 of the Tables, the reſidue will be the true correct height of the Sun. But note that if inſtead of 16' the Suns Semidiameter you ſubtract but 8 or 10 it will be ſufficient, the reſt being allowed for your height above the level of the Horizon.

The

The Figure of the Bow.



To obſerve the height of a Star, place the ſight Vane at A, and the Horizon Vane on the Arch at G, then looking through the ſight Vane at A, move the Vane F higher or lower, 'till you can ſee the ſtar by the Horizon through the Horizon Vane at G, ſo ſhall the Degrees and Minutes between the two Vanes F and G be the Altitude of the Star. So to take the Diſtance of two Stars, having placed the ſight Vane at A, and the Horizon Vane at G, look through the Vane at A, moving the Vane F to and fro on the Arch 'till you ſee the one ſtar through the Vane G, and the other by the Vane F, then do the Degrees and Minutes between the two Vanes F and G ſhew the diſtance of the Stars.

The Deſcription and uſe of the Plough.

This Inſtrument is Antient though now not much uſed.

It conſiſts of a ſtaff A L G, ſmall Arch H I, Croſs F K, and three Vanes, A an Horizon Vane, B a ſhade Vane, and C a ſight Vane, to move upon the Staff. This will ſupply many Inſtruments, even all that has been before mentioned, but here I ſhall ſhew only its proper uſe as a different or diſtinct Inſtrument from the other.

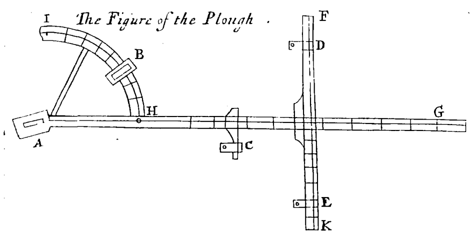
To obſerve the Suns Altitude with it.

Fit on the Horizon Vane, and place the ſhade Vane to any degree at pleaſure, ſo it exceed not the Altitude to be obſerved, nor be above ten

degrees

degrees less (which may indifferent well be judged of by the eye;) for in both these cases the divisions on the staff are deficient: then put the sight Vane on the staff holding up the Instrument, and turning the back of the Arch to the Sun, move the sight Vane on the staff backward and forward 'till the shade of the upper edge of the shade Vane, fall on the upper part of the slit of the Horizon Vane, and that at the same time looking through the sight Vane you may see the Horizon through the Horizon Vane, as above directed in the use of the Bow, then will the sum of the degrees on the Arch and on the staff be the Suns Altitude, allowing for the height above the Horizon, and for Refraction as before directed. If in observing you see the Sea instead of the Horizon, then remove the sight Vane towards the Arch: but if on the contrary you see the Sky, and not the Horizon, then draw the sight Vane backwards from the Arch. If you observe for a Meridian Altitude, then repeat this work as often as is thought fit 'till you find the Sun begin to fall.

The Figure of the Plough.



The Cross serves by taking the Horizon Vane off, and setting the end of the staff A to your eye, to find the Altitude with, after the manner of a Cross-staff.

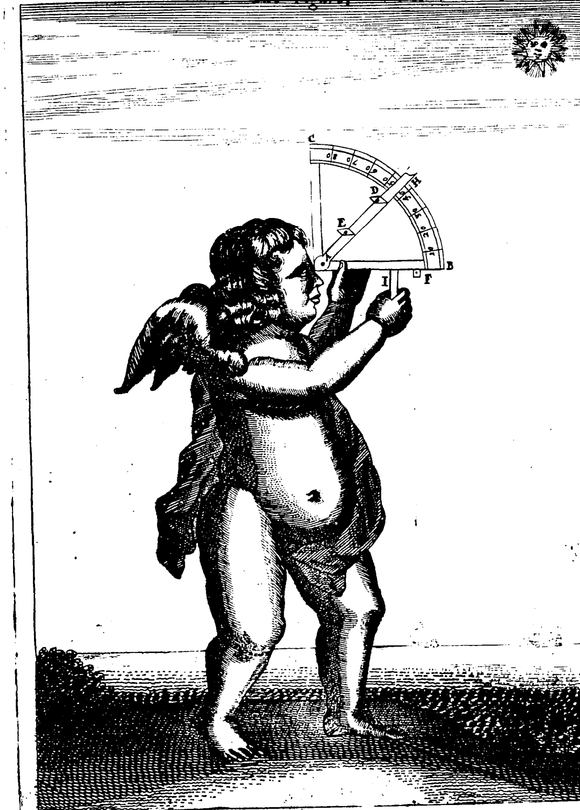
The Description and use of the Quadrant.

It's only a Quarter of a Circle accurately divided, having a moveable Index whereon are two sights, as also two other sights fixt to one edge of the Quadrant. *See the Figure.*

A is the Center, A B and A C the two sides, B C the limb, D E two sights fixed upon the moveable *Index* or *Label:* F G two other sights for observing the Horizon, I the Handle.

The

The Figure.



When you would Obſerve the Suns Altitude by it, take hold of the handle and holding the Quadrant as upright as you can, turn the limb to the Sun and look through the ſights F G, moving the Inſtrument too and fro 'till you can ſee the Horizon through them, then move the *Index* higher or lower 'till the bright ſpot coming through the firſt D, fall upon the ſecond ſight E, then ſhall the Arch H B be the Suns height required, allowing for your height above the level of the Horizon and for Refraction. If you be to obſerve the Altitude of the Moon or any Star, then after you have placed the ſide B A parallel to the Horizon, you muſt move the *Index* 'till the object (be it either Moon or Star) be ſeen through the holes or ſlits of the ſights D E placed on the *Index*, and then ſhall the Arch H B be the Altitude.

If you be to obſerve the diſtance of two Stars, hold up the Quadrant ſo that looking through the ſights F G you may ſee one of the Stars, then move the *Index* 'till you can ſee the other Star through the ſights thereon, then will the Arch H B be the diſtance required.

Of the common Sea Quadrant or Back-ſtaff.

This Inſtrument if well made is no whit inferiour to any before deſcribed, or ſcarſly to any that can be thought of for a backward Obſervation, it was the contrivance of one Captain *Davis* an Engliſh-man, and therefore is often called by us *Davis*'s Quadrant, but by the *French* the *Engliſh* Quadrant. It conſiſts of three Vanes A, B, C, and two Arches. That at A is called the *Horizon Vane*, that at B the *ſhade Vane*, becauſe of its giving the ſhadow upon the *Horizon Vane* in time of Obſervation, and that at C the *ſight Vane*, becauſe in time of Obſervation it's placed at the eye. The leſſer Arch *d e* is the ſixty Arch, and that marked *f g* the thirty Arch, both Arches together making 90 degrees, (yet of different *Radius*'s) whence its properly called a Quadrant. The ſixty Arch is divided into ſixty degrees, commonly by every five, but ſometimes by ſingle degrees. In time of Obſervation the *ſhadow Vane* is placed upon this Arch always to an even degree.

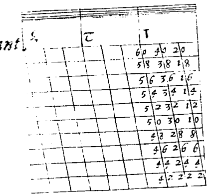
The thirty Arch is divided into thirty degrees, and each of thoſe degrees into minutes by Diagonal lines, and concentrick Arches, as follows.

To divide the limb of the Quadrant.

Upon the plain of this Arch deſcribe five, ſix, ten, or twelve Concentrick Circles, as you pleaſe, or as your Inſtrument will beſt bear, and between the terms of each degree draw, one, two, three, or more diagonal lines as you ſhall ſee convenient, noting this for a general Rule, that if you divide 60 the number of minutes in a degree, by the product of the number of concentrick Circles, multiplyed by the number of Diagonals in the

extent

of a Degree, the quotient will ſhew how many minutes each interſection of the Diagonals, and concentrick Arches increaſes by; as ſuppoſe the concentrick Arches on the Limb were 10, and the Diagonals in each Degree 3, then 10 multiplied by 3 makes 30, by which if you divide 60 the quotient is 2, which ſhews that the interſections encreaſe by two minutes, as you ſee them marked with ſmall numbers.



To Obſerve the Suns Altitude with this Quadrant.

Having put the *Horizon Vane* upon the upper end or center of the Quadrant at A, the *ſhade-Vane* upon the ſixty Arch *d e*, to a number of Degrees leſs than you judg the Co-altitudes will be by ten or fifteen Degrees, and the *ſight-Vane* upon the thirty Arch *f g*, turning your back towards the Sun lift up the Quadrant, and look through the *ſmall-hole* in the *ſight-Vane*, and ſo raiſe or lower the Quadrant, 'till the ſhadow of the upper edge of the *ſhade-Vane* fall upon the upper edge of the ſlit in the *Horizon-Vane*, if then at the ſame time the *Horizon* appear through the ſaid ſlit the Obſervation is finiſhed; but if the Sea appear inſtead of the *Horizon*, then remove the *ſight-Vane* lower towards *f*; but if the sky appear inſtead of the *Horizon*, then ſlide the *ſight-Vane* a little higher, and ſo continue removing your *ſight-Vane* 'till the *Horizon* appear through the ſlit of the *Horizon-Vane*, and the ſhadow of the *ſhade-Vane* fall at the ſame time on the ſaid ſlit of the *Horizon-Vane*. Then look how many Degrees and Minutes are cut by the edge of the *ſight-Vane* that anſwers to the *ſight-hole*, and to them add the Degrees that are cut by the upper edge of the *ſhade-Vane*, the ſum is the *Zenith* Diſtance or Complement of the Altitude. But to find the Suns *Meridian* or *greateſt Altitude*, you muſt continue your Obſervation as long as you ſee the Altitude increaſe, which you will perceive by having the Sea appear at the repeating the Obſervation inſtead of the *Horizon*, removing the *ſight-Vane* lower, but when you ſee the sky appear inſtead of the *Horizon*, the Altitude is diminiſhed, therefore deſiſt from farther Obſervation at that time, and

 add

add the Degrees upon the sixty Arch, to the Degrees and Minutes upon the thirty Arch, the sum is the *Zenith* distance or Co-altitude of the Suns upper limb or edge.

And because it is the *Zenith* distance or Co-altitude of the upper limb of the Sun, that is given by the Quadrant, when Observing by the upper edge of the *shade-Vane* (as it's customary to do) and not the Center, you ought to add 16, the Suns Semidiameter, to that which is produced by your Observation, and the sum is the true *Zenith* distance of the Suns Center. But if you Observe by the lower part of the shadow of the *shade-Vane*, then it's the lower limb of the Sun that gives the shadow, and therefore you must subtract 16′, from what your Instrument gives: but considering the height of the Observer above the water, which is commonly between 16 and 20 feet, you may take away 5 or 6′ from the 16′, and make the allowance but 10 or 12′ to be added instead of 16′.

Note also that the Refraction of the Sun or Stars causeth them to appear higher than they are: therefore when you have made your Observation look in *Page* 257 of the *Vol.* of *Tables*, for the Refraction answering thereto and subtract it from your Altitude, or add it to the *Zenith* distance, so shall you have the Altitude, or *Zenith* distance, exact and correct.

Of late there has been used a lens or double convex-glass, fixt in the *shade-Vane*, which contracts the rays, and casts them in a small bright spot on the slit of the *Horizon-Vane* instead of the shade, which has much improved the Instrument, if the glass be well and truly fixt: for now it may be used in hazie weather, and that so thick an haze that an Observation can hardly be made with the *Fore-staff*, also in clear weather the spot is more defined and conspicuous than the shadow, which at best is not terminated. This was the contrivance of Ingenious Mr. *Flamsted.*

Rules for finding the Latitude or height of the Pole, by the Zenith *Distance, or Meridian Altitude, of the Sun or Stars and their Declinations.*

Note that if the Sun or Star have no Declination, the *Zenith* distance is the Latitude, and if the Sun or Star come to the Meridian due North the Latitude is Southerly, if it come to the Meridian South, the Latitude is Northerly.

If the Sun or Star be in the *Zenith*, the Declination is the Latitude, and if the Declination be Southerly the Latitude is Southerly, but if the Declination be Northerly, the Latitude is Northerly.

Rule

Rule 1.

If the Declination be North or South either of the Sun or Stars, and the Meridian Altitude be the ſame way that the Declination is, the Difference between the Declination and *Zenith* diſtance is the *height of the Pole* towards which the Declination is.

Example 1.

The Declination North	23°	30′	ÆK	*Fig.* A.
The Zenith diſtance North	8	30	ZK	
the Latitude North,	15	00	ÆZ	

Except the Declination be leſs than the Zenith diſtance, then the contrary Pole to the Declination is elevated.

Example 1.

The correct Zenith diſtance South	71°	30′	ZK	*Fig.* B.
The Declination South	20	00	ÆK	
the Latitude North,	51	30	ÆZ	

Example 2.

The Zenith diſtance North	30°	00′	ZK	*Fig.* C.
The Declination North	20	00	ÆK	
the Latitude South,	10	00	ZÆ	

Rule 2.

If the Declination of the Sun or Stars be North or South, and the Zenith diſtance be contrary to the Declination, the ſum of the Co-altitude and Declination is the height of that Pole, that the Declination is towards.

Example 1.

The Zenith diſtance South	31°	30′	ZK	*Fig.* D.
The Declination North	20	00	ÆK	
Latitude North,	51	30	ZÆ	

Example.

But if the Sun or Star may have two Meridian Altitudes, which you ſhall know by the following inſtructions, then the ſum of the Co-declination and Altitude is the height of the Pole towards which the Declination is.

If the Declination be the ſame way that the *Meridian Altitude* is, and the Declination greater than the *Meridian Altitude*, then the Sun or Star may have two *Meridian Altitudes* in 24 hours, *viz.* the one above the Pole and the other below.

Example.

Fig. E.

Declination North 23° 30′ Complement	66°	30′	PK
The correct *Meridian Altitude* North	8	30	KO
The Elevation of the North Pole,	75	00	PO

Except the *Meridian Altitude* be more than the Declination, then you muſt ſubtract the *Zenith Diſtance* from the Co-declination, and the remainder is the height of that Pole towards which the Declination is.

Example.

Fig. F.

The Declination North	80°	00′	ÆK
The Zenith diſtance North	5	00	ZK
Latitude North,	75	00	ZÆ

Laſtly Note, that which way ſoever the *Meridian Altitude* be, if the *Meridian Altitude* and twice the Co-declination be leſs than 180 degrees, the Sun or Star hath two *Meridian Altitudes* in 24 hours, and by the ſecond Rule you may have the Latitude.

Example.

Fig. G.

The Meridian Altitude South	77°	00′	HK
The Declination 62° 00′ North, the Comp.	28	00	KP
	28	00	P π
The ſum,	133	00	leſs than

180° therefore by the ſecond Rule.

The Zenith diſtance South	13°	00′	KZ
The Declination North	62	00	ÆK
The Latitude is North,	75	00	ZÆ

To

To find the time of a Stars coming to the Meridian any day.

Having looked the Right-aſcention of both the Star and Sun in their proper Tables, Subtract the Right-aſcention of the Sun from the Right-aſcention of the Star: but if the Stars Right-aſcention be leſs than the Suns, ſo that you cannot ſubtract, add thereto 24 hours and then ſubtract, and the Remainder if under 12 hours is the time of the Stars coming to the Meridian afternoon, but if the Remainder be more than 12 hours ſubtract 12 therefrom, and the reſidue is the time after midnight.

Example 1.

September 15*th its required to know when* Fomahant *comes to the Meridian.*

I find in the Table *Page* 260 of the *Vol. of Tables*, the Stars Right-aſcention to be $22^h\ 41'$, and in the *Table Page* 258 the Suns Right-aſcention to be $12^h\ 10'$ which ſubtracted from the Stars Right-aſcention, leaves $10^h\ 31'$ the time of the Stars coming to the Meridian afternoon.

Example 2.

Suppoſe the time that Aldebaran *comes to the Meridian, the* 28*th of* Feb. 168$\frac{3}{4}$ *be Required.*

The Right-aſcention of the Star	22	40
Twenty four hours added	24	00
	46	40
The Suns Right-aſcention to be ſubtracted	23	25
The time of the Stars coming to the Meridian that night	23	15

The Deſcription and uſe of the Nocturnal.

There are many kinds of Nocturnals, ſome for one Star ſome for another, of which we ſhall take notice only of two, the one made for the Conſtellation of the *great Bear*, and the other for the *little Bear*. And they both conſiſting of like parts, one deſcription ſhall ſerve both.

This Inſtrument then is compoſed of three pieces or parts, the firſt and biggeſt on which is the handle by which to hold it in time of Obſervation, hath on the foreſide two Circles, in the outermoſt of which are the days of the Months, and upon the innermoſt the 24 hours of a day Natural: upon the backſide are the 32 Points of the Compaſs, and ſometimes eſpecially if it be for the *little Bear*, the diſtance of the Pole Star above or beneath the Pole.

It.

If the Nocturnal be for the Pointers (or as some call them the Guards) of the *great Bear*; then you will see in the Circle of Months *February* 17 at the top, because the Star that night comes to the Meridian at midnight; but if it be for the Fore-gard of the *little Bear* you will see *April* 25 at the top right under the middle of the tip, for the like reason.

The second or middle Piece or Part contains two Circles, and a small Tooth or Index, the outermost Circle is divided into $29\frac{1}{2}$ days for the Moons age, the innermost into 24 hours. The Index is a little short peg standing out from the edge, and is to be set to the day of the Month as occasion requires.

The third and upper or innermost Part or Piece is a long Index, the edge of which that comes from the center must be brought over the Guards in Observing. Sometimes one Instrument is made to serve both *Bears*.

To find the hour of the Night, and upon what point of the Compass the Guards are.

First, Set the Tooth of the middle Part to the day of the Month, then lift up the Instrument and hold it as upright as you can with the fore side towards you; and afterwards bow the upper end or tip on the top of the Nocturnal, so much towards you, that looking through the hole in the middle of the Nocturnal you may see the Pole Star: Now when you see the Pole Star through the hole, turn the long Index or Rular about 'till by the edge coming from the Center, you can see the *first of the Guards* of the *little Bear*, or to the *Pointers* of the *great Bear*, if for the *great Bear*, then shall the edge of that Index or Rular shew upon the innermost Circle of the middle Part or Piece the hour of the Night; and at the same time on the backside of the Nocturnal the Point of the Compass on which the Guards are.

If you desire to be more exact in the time of the Night take the Altitude of some known Star, and proceed according to the Directions in *Page* 155 of the *Cosmography*.

To find the time of the Moons coming to the Meridan by the Nocturnal.

Look for the Moons age in the outermost Circle upon the middle Piece of the Nocturnal, and right against it on the innermost Circle of the same Piece stands the time of her coming to the Meridian.

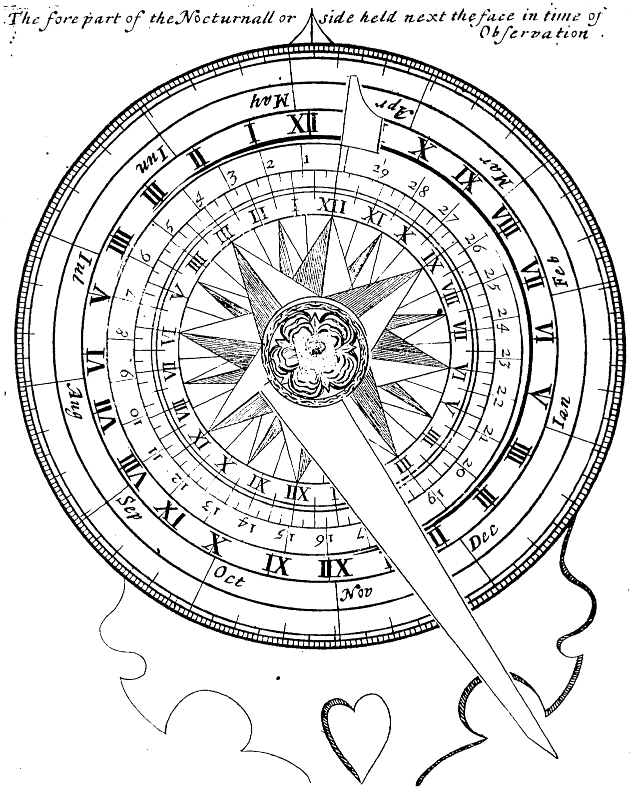
To find the Time of her coming to the Meridian otherwise.

Multiply her age by 4 and divide the Product by 5, and the Quotient gives hours, and every unit that remains is 12 minutes more.

Admit the time of the Moons coming to the Meridian, be required for *May* 18, 1681.

Her

The fore part of the Nocturnall or side held next the face in time of Observation.



between Page 254 and 255.

If the Nocturnal be for the Pointers (or as some call them the Guards) of the *great Bear*; then you will see in the Circle of Months *February* 17 at the top, because the Star that night comes to the Meridian at midnight; but if it be for the Fore-gard of the *little Bear* you will see *April* 25 at the top right under the middle of the tip, for the like reason.

The second or middle Piece or Part contains two Circles, and a small Tooth or Index, the outermost Circle is divided into $29\frac{1}{2}$ days for the Moons age, the innermost into 24 hours. The Index is a little short peg standing out from the edge, and is to be set to the day of the Month as occasion requires.

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To find the hour of the Night, and upon what point of the Compass the Guards are.

First, Set the Tooth of the middle Part to the day of the Month, then lift up the Instrument and hold it as upright as you can with the fore side towards you; and afterwards bow the upper end or tip on the top of the Nocturnal, so much towards you, that looking through the hole in the middle of the Nocturnal you may see the Pole Star: Now when you see the Pole Star through the hole, turn the long Index or Rular about 'till by the edge coming from the Center, you can see the *first of the Guards* of the *little Bear*, or to the *Pointers* of the *great Bear*, if for the *great Bear*, then shall the edge of that Index or Rular shew upon the innermost Circle of the middle Part or Piece the hour of the Night; and at the same time on the backside of the Nocturnal the Point of the Compass on which the Guards are.

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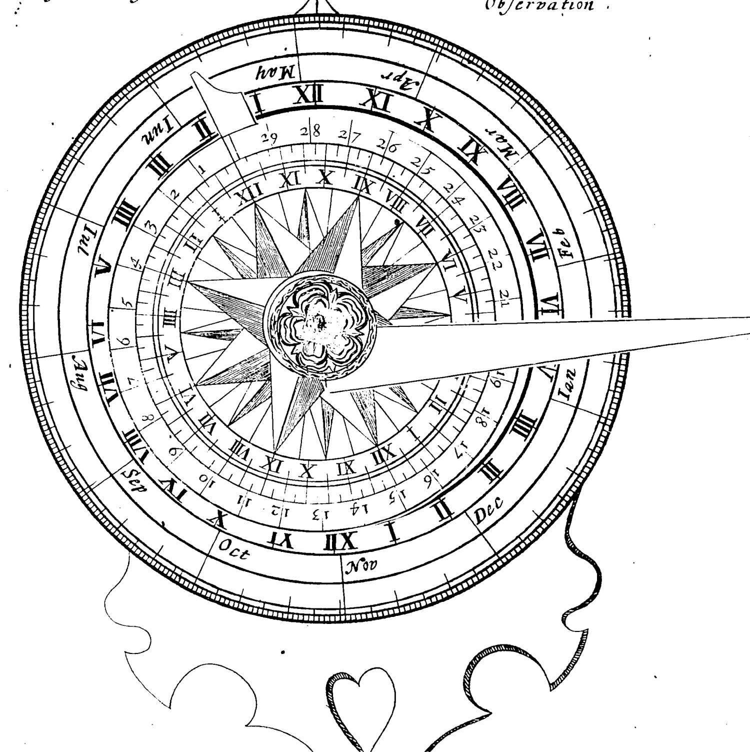
Multiply her age by 4 and divide the Product by 5, and the Quotient gives hours, and every unit that remains is 12 minutes more.

Admit the time of the Moons coming to the Meridian, be required for *May* 18, 1681.

Her

The fore part of the Nocturnall or side held next the face in time of Observation.



between Page 254 and 255.

Her age is found according to the Directions in the *Cosmography* to be 11 days, which multiplied by 4 makes 44, and this divided by 5 gives 8 hours, and for the 4 remaining you must add 48', so the time of her Southing is 48 minutes after eight of the Clock.

The reason why you are directed to multiply by 4, and divide by 5 is because allowing the Moon 30 days between New and New, she departs 12 degrees which is $\frac{4}{5}$ of an hour each day from the Sun.

To find the time of High-water in any Place.

Add to the time of the Moons coming to the Meridian on the given day, the time of high water in that place on the day of the change or full, and the sum is the time of high water on the day proposed.

The time of high water on the change day is found by Observation at every particular place.

May 18, 1681. Let it be required to find the time of high water at *London*, where it flows constantly 'till three of the Clock on the days of the New and Full Moon.

The time of the Moons Southing this day was found to be 8^h 48', to which if you add 3^h, the sum 11^h 48', is the time of high water there that day. But this is sometimes very much wide of the truth.

To find the time of High water more truly by the following Table.

The ☽s. Age Days.		Tides H.	Tides M.
1	16	0	43
2	17	1	20
3	18	1	52
4	19	2	22
5	20	2	52
6	21	3	26
7	22	4	07
8	23	4	55
9	24	5	50
10	25	6	53
11	26	7	59
12	27	9	04
13	28	10	08
14	29	11	05
15	30	12	00

Look the Moons age in the first Column, and the Number right against it in the second, being added to the hour of High water on the change day, makes the exact time of High water at the Place and time proposed.

Thus, right against 11 days I find 7^h 59', to which adding 3^h the sum is 10^h 59', the true time of High water at *London*, differing almost an hour from the time given the other way. But this is out of place, and therefore I shall forbear any farther discourse hereof.

A Table

A Table of the Diſtance of the Pole Star, above or beneath the Pole, upon every Point of the Compaſs, the Guards and Pointers are upon.

	Points on the Nocturnal.	*For the foremoſt Guard of the little Bear.* °	′			*For the Pointers of the Great Bear.* °	′	
If the foremoſt of the Guards be aſcending from the North, or lower part of the Meridian.	North	2	09	The Pole ſtars is above the Pole.	If the Pointers be aſcending from the North or lower part of the Meridian.	2	20	Pole Star above the Pole.
	N by E	1	52			2	30	
	N N E	1	29			2	35	
	N E by N	1	02			2	33	
	N E	0	35			2	26	
	N E by E	0	06			2	13	
	E N E	0	22	The Pole Star is under the Pole.		1	55	
	E by N	0	52			1	33	
	Eaſt	1	18			1	07	
	E by S	1	41			0	38	
	E S E	2	01			0	08	The Pole Star under the Pole.
	S E by E	2	16			0	22	
	S E	2	25			0	52	
	S E by S	2	30			1	20	
	S S E	2	29			1	44	
	S by E	2	22			2	04	
	South	2	11			2	20	
If the foremoſt of the Guards be deſcending from the So. or upper part of the Meridian.	S by W	1	55		If the Pointers be deſcending from the South or upper part of the Meridian.	2	30	
	S S W	1	34			2	29	
	S W by S	1	10			2	28	
	S W	0	43			2	26	
	S W by W	0	14			2	13	
	W S W	0	15			1	55	
	W by S	0	44			1	33	
	Weſt	1	11	The Pole Star above the Pole.		1	07	
	W by N	1	36			0	38	
	W N W	1	58			0	08	
	N W by W	2	14			0	22	Star above the Pole.
	N W	2	25			0	52	
	N W by N	2	30			1	20	
	N N W	2	29			1	44	
	N by W	2	22			2	04	

The

The uſe of this Table of the North Stars diſtance above or beneath the Pole.

Having taken the Altitude of the Pole Star; Obſerve with the Nocturnal as before directed, upon what point of the Compaſs the Guards or Pointers are: then look in this Table for the diſtance or declination, and if the ſtar be below the Pole add it to the Altitude; but if the Star be above the Pole ſubtract, and the ſum or remainder is the Latitude of the Place.

There ought to have been in the compoſing of this Table, ſome conſideration to the Latitude: but the error that can at any time ariſe upon the omiſſion of that conſideration is only 4′ at the moſt, when as you cannot have by your Nocturnal the Point the Guards are upon nearer than ¼ or ½ a Point, which makes a much more conſiderable error, and therefore this is not to be taken notice of.

Of the Compaſs.

This Divine Inſtrument the Compaſs, whoſe rare properties are truly admirable, and worthy of all mens contemplation and endeavours to explicate, eſpecially Philoſophical men, conſiſts only of a Card and two Boxes. The Card is ſuch as you have ſeen *Page* 173, with a ſmall Cupulo or braſs Center, with two wyers glewed to the under part, the ends directly under the North and South points of the Card. Theſe wyers ought to be of Steel well tempered bended together in the form A, ſo that the ends joyn cloſe and even, and to be touched with a good Loadſtone, which is that which gives it life, and a property of ſtanding with its North and South Points inſpecting the North and South Points of the Horizon, or points in the Heavens where the Meridian and Horizon interſect, and conſequently all the other points, to inſpect points or Azimuths in the Heavens at like diſtance from the Meridian; yet not ſo conſtant but that moſt times it has a Deflection or Variation, that is, the Meridian or North and South Line of the Card points ſome degrees from the interſections of the Horizon and Meridian or true Meridian line, which though taken by ſome for an imperfection, I rather take to be its greater perfection,

A

 Providence

Providence therein pointing at ſome things more excellent than yet apprehended, that are greater Myſteries in the frame and compoſure of the World; and it's now a greater good to mankind than if it had only been directed conſtant without any Variation, as every man that has been at the *Eaſt Indies* can make evident.

This Card or Fly thus ordered is put into a ſmall round Box fit for it, having a pin in the middle on which the hollow of the Cupulo is to be placed, and the Card poiſed that it may lie Horizontal in the ſaid Box, and ſwing freely according as the Vertue of the touch ſhall lead it.

This Box is to be hanged in two Circles or hoops of Braſs, or Tin, and thoſe with the Box put in another Box, that this inermoſt Box, and conſequently the Card, may ſtand Horizontal, which way ſoever the Ship heelds.

As to the touching of the wyers, let the ſtone be good, the bigger the better, ſo of the ſame goodneſs in equal quantity and of the ſame ſhape, and let the wyers be ſmooth and polliſhed, then begin your touch near the middle of the wyer, and preſſing it pretty hard on the Pole of the Stone, draw it ſlowly along to the very end of the needle, and lifting your hand a good diſtance from the Stone while you put the wyer forward again, begin a ſecond touch in the ſame manner, and after that a third, which is enough, unleſs you will touch the other end of your wyers alſo, and then you muſt touch that with the other Pole of the Stone in the ſame manner you did the former, always remembring not to rub the wyer too and fro on the Stone, whereby the backward rubs take away what vertue the forward ones gave, but lift it out of the Sphere of the Stones Virtue, when you carry it forward again to begin a new touch.

The Deſcription and Uſe of the Azimuth Compaſs, or Compaſs to obſerve the Magnetical Azimuth, that is the Suns Azimuth from the North or South points of the Compaſs.

This is ſomewhat differing from the common *Sailing Compaſs*, for upon the round Box (wherein are the Fly and wyer) is faſtened abroad Circle of braſs, one ſemicircle thereof is divided into 90 equal parts or Degrees, numbred from the middle of the ſaid Diviſions both ways, wiſh 10, 20, &c. to 45 Degrees: which Degrees are alſo ſubdivided into minutes by Diagonal lines, and Circles after the ſame manner that the Limb of the *Davis* Quadrant was: but theſe graduating lines are drawn from the oppoſite part of the Circle, *viz.* from that point whereon the Index turneth in time of Obſervation.

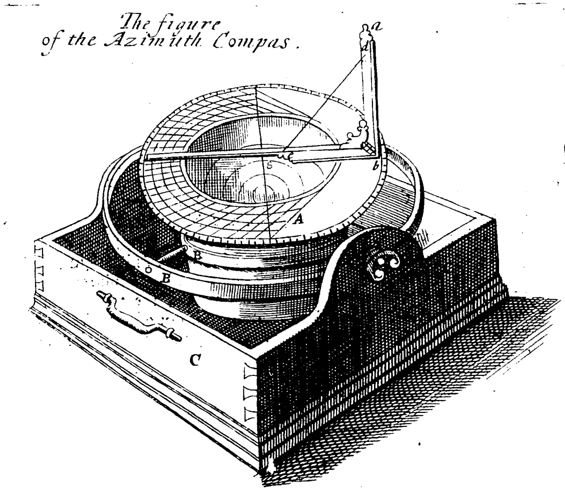
On this Index is erected a ſight which moves with a hinge, that it may be raiſed or laid down as occaſion requires, and from the upper part of this ſight, down to the middle of the Index, is faſtned a fine thred or Lute-ſtring, to give a ſhadow upon a line that is on the midle of the ſaid Index.

The

The reaſon of making the Index to move on a pin that's faſtened to the circumference, is that the degrees and diviſions might be the larger: for now they are as large again as they would have been if divided from the Center, and the Index made to move thereon *vide* 20 *e* 3.

This broad braſs Circle is croſſed at right Angles with two threads, and from the ends of thoſe threads are drawn 4 ſmall black lines on the inſide of the Box, alſo there are 4 right lines drawn at right Angles one to the other on the Fly.

This Box thus fitted with its Fly, graduated Circle, and Index, &c. is to be hung, in Rings or Hoops of Braſs or Copper, and thoſe to be faſt'ned into another Box, which is commonly ſquare. *See the Figure.*



A is the great Broad graduated braſs Circle.
b c the Index, moveable on the point *b*.
b a is the ſight erected.
d e the Hypothenuſal Lute-ſtring, or thread.
B B th[illegible]ſs or Copper Hoops, or Rings which the round Box hangs in.
C C the [illegible] Box that contains all the reſt.

To

To Observe the Magnetical Amplitude or Azimuth.

If the Observation be for an Amplitude at Sun Rising or an Azimuth before noon, you must put the Center of the Index upon the West point of the Card or Fly within the Box; so that the four lines on the edge of the Card, and the four lines on the inside of the Box may agree or come together. But if the Observation be for the Suns Amplitude setting, or an Azimuth afternoon, then you must turn the Center of the Index right over the East point of the Fly, and make the lines within the Box to concur with those on the Fly. Having thus fitted the Instrument for the Observation, turn the Index towards the Sun, 'till the shadow of the thread *d e* do fall directly on the slit of the sight, and upon the line that is along the middle of the Index; then will the inner edge of the Index cut the degree and minute of the Suns Magnetical Azimuth from the North or South.

But note, that if the Compass being thus placed, the Azimuth be less than 45 degrees from the South, and you turn the Index towards the Sun, it will then pass off the divisions of the Limb, and so they become useless as it now stands. Therefore you must turn the Instrument just a Quarter of the Compass, that is, place the Center of the Index on the North or South point of the Card according as the Sun is from you, and then the edge thereof will cut the degree of the Magnetical Azimuth or Suns Azimuth from the North as before.

Having by this Instrument found the Magnetical Azimuth or Amplitude, find the Suns true Azimuth by calculation according as directed in *Problem* 12 of the 3 *Section* of the Cosmography, and the true Amplitude by *Problem* the 9th of the said *Section*, or take it out of the Table of Amplitudes *Page* 38, &c. of the *Vol.* of Tables; then to find the Variation, and which way it is, do as followeth.

With the Chord of 60 describe a Circle, and Quarter it with two Diameters at Rightangles the one to the other, writing against the extreams of the Diameters, North, South, East, West, as you see in the figure, then take the true Amplitude or Azimuth, and prick it from the right point the right way, and so also prick off the Magnetical Amplitude or Azimuth.

Lastly, Take the distance between the Magnetical Amplitude or Azimuth and the North, and set it from the true Amplitude or Azimuth Northward, and the foot of the Compasses will fall in a certain point, from which if you draw a line through the Center, that line will represent the North and South line of the Compass or Magnetical Meridian, and that way that this point lieth from the North that way is the Variation, and just so much as is the Arch between the said point and the North, which may be measured by the Chords.

Example

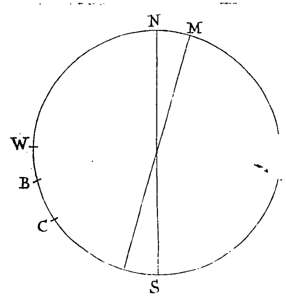
Example 1.

Admit one being in the Latitude 48° 00' North, the Sun having 18° 00' North Declination, observes the Magnetical Amplitude at Sun rising to be 36° 00' from the East Northward: and would know the Variation of the Compass.

First, With this 18° Declination, and 48° Latitude entering the *Table of Amplitudes*, *Page* 42 of the *Vol.* of *Tables*, you'll find the *true Amplitude* to be 27° 30'.

Then having described the Circle and quartered it, prick the *true Amplitude* from E or the East point towards the North to B, and taking the *Magnetical Amplitude* 36°, prick that also from E Northward to C, and taking in the Compasses the distance between C and N the North, set one foot in B the point of *true Amplitude*, and the other being turned towards the North reaches to M, the point to which the North point of the Compass is directed, so that M N 8° 30' is the quantity of *Variation*, and because M falls towards E, that is between N and E, it is Eastward.

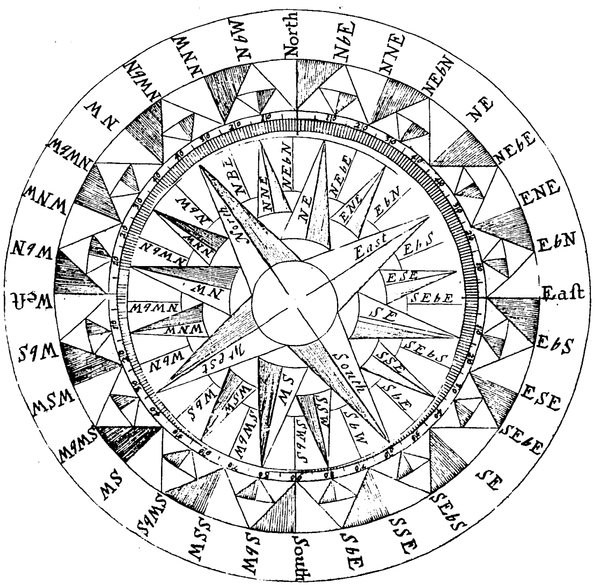
Mag. Ampl.	36°	00'
True Ampl.	27	30
Variat.	8	30



Now if you take an old Compass Card, and lay within this Circle, so that its North and South line may lie on the line M P, then will this Compass Card represent the Varied Compass, and the Circle N E S W the Horizon or Compass without Variation, so that if you take with a pair of Compasses the distance between the North or point N, of this outermost Circle, and the point of your Course on the Varied Compass, or Card representing it, and afterwards set one foot on M, the other will shew on the Compass Card amongst the points the True Course.

Or

Or thus, you may have two Compaſs Cards, to move one upon the other, as you ſee here, and taking the true Amplitude from the graduated limb ſet it from the Eaſt point, if the Obſervation be at riſing, or elſe Weſt point of the under or fixt Compaſs, either towards the North or South according as the Amplitude is, prick alſo the Magnetical Amplitude thereon after the ſame manner as to C, then take the diſtance between the point of *Magnetical Amplitude* C, and the North point of the lower or fixt Compaſs, prick it from B, the point of true Amplitude to M, and bring the North point of the moveable or upper Compaſs to M: then if you look any Courſe on the upper Compaſs, the point againſt it on the neather Compaſs is the true Courſe, or the Contrary.



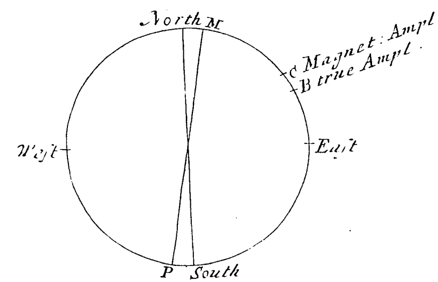
Example

Example 2.

In Latitude 41° 00′ North, the Sun having 17° 00′ Declination South, the Magnetical Amplitude at Sun-ſet is obſerved to be 36° 00′ from the Weſt Southward, what is the Variation, and which way is it?

By entring the Table of Amplitudes with the Latitude and Declination as before directed, the *true Amplitude* will be found to be 22° 47′, which being pricked on the Circle from W (as before directed) to B, and alſo the *Magnetical Amplitude* to C, the diſtance between MN ſhews the Variation to be be 13° 13′, and that Eaſtward from the North.

Mag. Ampl.	36°	00′
True Ampl.	22	47
Variat.	13	13



Example

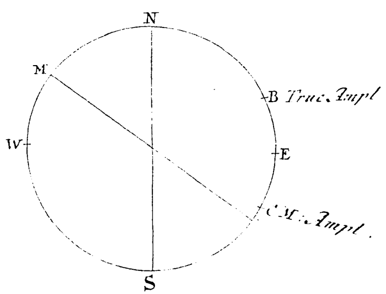
Example 3.

Let the Declination be ——————— 15° 00′ North
The Latitude be ——————— 50 00 North
And the Magnetical Amplitude at Sun rising ——— 29 00 South
And it be required to find the Variation of the Compass.

Having described a Circle and quartered it, prick the *true Amplitude* (which by the Table of Amplitudes is found to be) twenty three Degrees forty four Minutes from E the East point towards the North to B, and the *Magnetical Amplitude* 29° 00′, from E Southwards (according to the Observation) to C: then taking the distance between C the *Magnetical Amplitude*, and N the true North, set it from B Northward, and it finds the point M, the Distance between M and N is 52° 44′ the Variation, which is Westward, because M falls between N and W.

Mag. Ampl.	29°	00′
True Ampl.	23	44
Variation	52	44

From the North Westward.



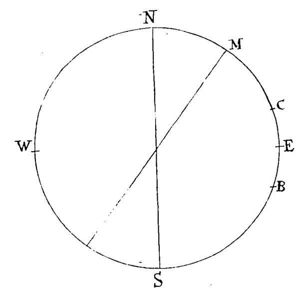
Example 4.

Let the Declination be ——————— 11° 00′ South
The Latitude be ——————— 49 00 North
And the Magnetical Amplitude at Sun Rising ——— 17 00 North
To find the Variation.

The *True Amplitude* by the Tables is 16° 54′, from the East Southward, because the Declination is South.

Magnetical Amplitude ———————	17°	00′
True Amplitude ———————	16	54
The Variation from the North Eastward ———	33	54

As is seen by the Figure.



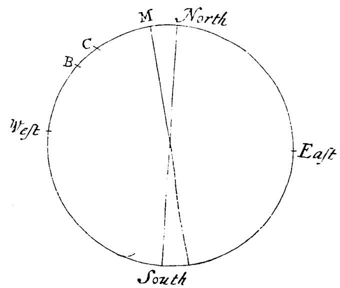
Example 5.

Being in Latitude 51° 30′ North, the Sun having 21° 00′ Declination North, I observe the Magnetical Amplitude at Sun set to be 49° 00′ from the West Northward, and require the Variation.

First, by entring the *Table of Amplitudes*.
I find the *True Amplitude* to be 35° 8′, which being pricked on the Circle, as before directed, and also the *Magnetical Amplitude*.

I see thereby the Variation to be 13° 52′, that is, the North point declines from the true North, or intersection of the Horizon and Meridian 13° 52′ towards the West.

Magnetical Amplitude	49°	00′
True Amplitude	35	08
The Variation	13	52



EXAMPLES.

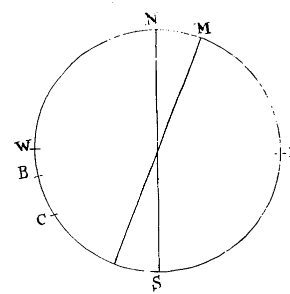
The Variation by the Azimuth.

Example 1.

May 1, 1680. Afternoon, in the Latitude 59° 00′ North, the Sun having 30° 00′ Altitude, the Magnetical Azimuth was Observed to be 126° 30′ from the North westward, that is, 53° 30′ from the South Westward: what was the Variation of the Compass?

By calculation as directed in the Cosmography, the true Azimuth is found 74° 26′ from the South Westward, which you must prick from S Westward to B, and the *Magnetical Azimuth* 53° 30′ from S to C: then taking the distance C N, and setting it from B Northward, it will find the point M, and M N is the Variation.

True Azimuth	74°	26′
Mag. Azimuth	53	30
The Variation from the North Eastward.	20	56

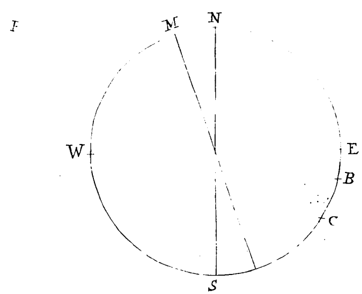


Example 2.

May 9, 1680. Beforenoon, in Latitude 58° 00′ North, the Sun having 32 00′ Altitude, the Magnetical Azimuth from the North was Observed 127° 00′, which is 53° 00′, from the South Eastward: what was the Variation?

By the Latitude, Declination, and Altitude, the *True Azimuth* will be found to be 76° 10′ from the South, which being pricked on the Circle towards its proper Coast, and also the Magnetical Azimuth 53° 00′, the Variation will appear to be 23° 10′, from the North Westward.

True Azimuth	76°	10′
Mag. Azimuth	53	00
The Variation.	23	10



Of

Of the Quantity of a Degree of a great Circle on the Earth, and how it's found.

THere are many ways of discovering the quantity of a Degree on Earth, but none so natural as that used by our Country-man Mr. *Norwood*, which was to measure withal exactness possible the distance between some two places lying directly under the Meridian, or North and South one of another the farther distance the better, and to Compare that with the Degrees and Minutes in the difference of the Latitudes of those two Places, the Latitudes of both places being observed with all the niceness and curiosity imaginable. By this means he found no less than 367200 of our *English* feet to answer to a Degree of Latitude, which hath been farther since confirmed by many other experiments in our own Country, but the greatest confirmation is that by the very same manner of Experiment, *viz.* by measuring between two places under a Meridian in *France*, hath been found 365184 *English* feet in a Degree. But Mr. *Norwood* considering that the Ships way is more than is realy given by the *Log-line*, and that it is more safe to have the Reckoning somewhat before the Ship, flung away the 7200, retaining only 360000 to one Degree, and consequently 6000 feet to a Minute or $\frac{1}{60}$ part of a Degree, according to which account there is of our Statute measure of 5280 feet to the Mile, $68\frac{2}{11}$ Miles to a Degree, and of the *English* Sea Miles, or *Italian* Miles of 5000 to the Mile, 72 Miles, or 24 Leagues in a Degree, and the whole Circumference of the Earth is 8640 Leagues, which is 120 Leagues less than the *French* experiment makes it, and than really are.

5280) 360000 (68	5|000) 360|000 (72	360
3168	35	24
4320	10	1440
4224	10	720
960	0	8640

Of the Estimation of a Ships way at Sea.

In the now practice of *Navigation*, there's hardly any thing more necessary than to be able to make a good estimate of the Ships way with any Wind.

For

For which many ways have been thought of by Wheelworks, *&c.* but to little purpose, the Nations now of Fame and Experience at Sea making better work, by means of less contrivance and intricasie. Some only guessing by the Sail born and running of the froth or water by the Ships side, as the *Spaniards* and *Portugness*, others by flinging into the water a Chip or the like, and counting how many equal timed paces they can make on the Deck, while the said Chip drives between any two bolt heads or marks on the side, which is usual amongst the *Dutch*: But the most approved way and now most followed, is by our *English-Log* and *Log-line*.

Of the Log, and Log-line,

The *Log* is only a piece of wood, which being tyed to a line and cast over board, and the line veered out as fast as the *Log* will carry it away, or as the Ship Sails so that it may have leave to pull away as much line, as it can without being dragged by the Ship, any more than what the weight of the line will do, doth shew according to the time it's veering how much she has Sailed, and consequently her rate of Sailing.

This line at about 10 Fathoms from the *Log*, (which is allowed that the *Log* may be out of the eddy of the Ships wake, before the half minute, which is the time most commonly allowed for the veering the line, begins to run) has a mark or knot for the beginning, and from thence is marked into spaces called knots.

The space of line between knot and knot ought to be such a part of a Minute of a Degree, as the half Minute of time is of an hour, so that the half Minute being the one hundredth and twentieth part of an hour, the length of line between knot and knot should be the one hundredth and twentieth part of a minute of a Degree of a great Circle of this Terraqueous Globe. And a minute being as is before proved six thousand *English* feet, the length of the line between the knots ought to be 50 feet: But they are commonly knit at but 7 Fathoms or 42 feet distance, grounding upon this error, that there's but 300000 feet in a Degree, and but 5000 in a Minute. Yet it being still found by the Ships run, that this did not answer to the parts of a Degree, they have lessened their half Minute by about five seconds of time, which brings it to the same thing in effect. Nevertheless it were to be wished that the latter though it serve a turn, might be omitted, and the true half minute brought in use with the *Log-line* knit at its true lengths.

```
12|0)  600|0 (50
       60
       --
        00
```

So

So many knots as are veered in half a Minute, so many Miles the Ship Sails in an hour, or so many Leagues and so many Miles in a Watch, or four hours.

As three knots in half a minute is three Miles in the hour, or four Leagues in a Watch; Four knots in half a minute is four miles in an hour, or five Leagues one mile in a Watch.

The *Log* is commonly thrown every two hours, but some throw it every hour. Every Noon if possible the Latitude ought to be Observed, but whether Observation or none, the Master and his Mates, then call for the *Log-board*, and add up the knots and Fathoms run since the last noon, the sum shews the miles Sailed that twenty four hours, if the *Log* were Cast every hour; but if it were cast but once in two hours, they double the sum of the knots run, and that shews the miles Sailed. If you would have the Leagues Sailed divide by three.

This account ruff taken off the *Log-board*, ought to be entred into a Book called a *Traverse Book* or *Log Book*, and afterwards the Traverse from last day noon being worked, and the difference of Latitude and Departure found and Corrected by Observation if any made, must be entred fairly in another *Book* called a *Journal*.

The

The Traverse or Log-Book for a Voyage intended by Gods assistance, for the Cape Good-hope in the Ship of London.

Anno, 1679.

h	*k*	*fa.*	*Courses.*	*Winds.*
4	16	0	S S W	E S E
5	6	1		
6	6	0	W S W	
7	6	3		
8	6	5		
9	6	3		
10	6	0		
11	6	4		
12	6	4		
	66	6	*Miles*	*Run.*

June 9th. Being Munday, at about ½ an hour after 4 in the morning, we saw the *Lizard* point bear N N E about 4 Leagues off us. We had a fresh gale, fair weather, and smooth water.

Zenith Dist.	26°	25′	The true Differ. of Lati. is 35′, with which and the Dist. run 64 *m.* the true Course will be found to be West 33° S. and the Meridi. Distance 53 *m* West.
Declination	23	10	
Lat. by Obser.	49	35	

h	*k*	*fa.*	*Courses.*	*Winds.*
1	6	0	W S W	E S E
2	5	6		
3	5	5		
4	6	0		
5	5	4		
6	5	5		
7	5	6	—	S E
8	5	6		
9	4	4		
10	3	2		
11	2	4	—	S E by S
12	2	0		
1	1	3	—	S E
2	1	1		
3	1	4	—	E
4	1	5		E N E
5	1	0		
6	1	3	—	N E
7	1	1		
8	1	3	—	N N E
9	1	6	—	N E
10	1	6	—	N E by E
11	2	0		
12	2	2		
24	77	6	*Miles*	*Run.*

June 10th. Being Tuesday, was fair weather, smooth water, the wind decreasing by Degrees till Midnight.

Zenith Dist.	25°	50′	The true Course I allow to be West 26° Southerly, whence the Dist. run will be 91 *m.* the Diff. of Lat. 40 *m*, and the Merid. Dist. 81 *m* West.
Declination	23	05	
Lat. by Obser.	48	55	

h	*k*	*fa.*	*Courses.*	*Winds.*
1	2	6	W S W	N E
2	2	6		
3	2	5		
4	2	5	N by E	
5	3	0	N E	
6	3	1		
7	3	6	E N E	
8	3	6	S E	
9	5	1	W	N
10	5	5		
11	4	3		
12	5	0		
1	5	0		
2	5	5		
3	5	5		
4	5	0		
5	5	4		
6	5	0		
7	5	2		
8	5	0		
9	5	0		
10	5	3		
11	5	2		
12	4	0		
24	[illegible]	[illegible]	*Miles*	*Run.*

June 11th. Wednesday, thick hazy weather, in the night some thunder and lightning, at four in the morning we out with a top Sail more.

Zenith Dist.	25°	29′	The true Course I conclude to be West 19° South, the Distance 83 *m*, and Meridian Distance 78 *m.* West.
Declin. North.	22	58	
Lat. North.	48	27	

h	*k*	*fa.*	*Courses.*	*Winds.*
1	2	0	N W	W S W
2	2	4	S S W ½ Sly	W
3	3	4		
4	3	6		
5	4	0	S S W	
6	3	0		
7	3	1		
8	2	5	S W by S	W by N
9	1	0		
10	*Calm*			
11	0	0		
12	1	4	S	W S W
1	1	4	S S W	W
2	1	0	S W by W	N W by W
3	0	[illegible]		
4	0	[illegible]		Round
5	0	0		
6	0	0		
7	1	4	S W by W	
8	1	3		
9	[illegible]	[illegible]		
10	2	0	S W	S S E
11	2	3		
12	2	6	S W by W	S by E
24	42	3	*Miles*	*Run.*

June 12th. Thursday, little winds, fair weather, and smooth-water, we saw three Sail on our Star-board bow.

Zenith Dist.	24°	50′	The true Course I make to be South 31° West, the Distance 48 *m*, and the Merid. Distance 25 *m.* West.
Declin. North,	22	55	
The Lat. North.	47	45	

h	*k*	*fa.*	*Courses.*	*Winds.*
1	2	4	S W	S S E
2	3	0		
3	2	0		
4	2	0		
5	2	5		
6	2	5		
7	2	2	S W by W	S by E
8	1	1		
9	2	0	W	S by E
10	2	3	W by S	*we bore up.*
11	2	0	S W by W	
12	2	4	S W ½ W	S S E
1	2	4	S W	
2	3	2		
3	3	3		
4	2	6		
5	2	0		
6	2	0		
7	2	0		
8	1	4	S W by W	S by E
9	1	0	S W	S S E
10	0	4		
11	1	0		
12	0	3		
24	50	1	*Miles*	*Run.*

June 13th. Fryday, little wind, fair weather and smooth Water.

Zenith Dist.	24°	31′
Declin. North.	22	48
Lat. North.	47	19

The true Course I make to be West 32° South, Distance Run 49 *m.* and the Meridian Distance 41 *m.* West.

h	*k*	*fa.*	*Courses.*	*Winds.*
1	1	0	S W	S S E
2	1	0	S W by W	S by E
3	0	6	W S W ½ S	S
4	1	2		
5	0	3		S by E
6	1	0		
7	[illegible]	6	S W by W	
8	1	1		
9	2	2	W ½ S	
10	1	5		
11	0	6	W	
12	1	1		
1	1	1	S W ½ W	S S E
2	1	3	S W by W	S by E
3	1	4		
4	2	0		
5	2	4	S W	S S E
6	3	3	S W by W	S by E
7	3	0	W S W	S
8	2	6		
9	3	0		
10	0	0	*we lay by*	
11	2	3		
12	2	0	W by S	S by W
24	39	0	*Miles*	*Run.*

June 14th. Saturday, the wind very scant, the weather prety fair, a great Sea coming from the South West, which makes us believe we shall have fresh South Westerly winds to morrow.

Zenith Dist.	24°	30′
Declin. North,	22	43
The Lat. North.	47	13

The true Course I make to be West 10° South, her Distance Run 37 *m*, and her Merid. Distance 36 *m.* West.

The

The *Journal* to the former *Log-Book*, for a Voyage intended by God's assistance for the Cape *Buona Speranca.*

Anno, 1679.

Month & Days.	*Latitude by Observation.* °	′	*True Course correct by Variation.* °	*Correct. Dist.* M.	*Northing* Miles	*Southing.* Mil.	*Eastings.* Mil.	*Westings.* Mil	*Departure from the Lizard, or Long. according to the P. C.* °	′	*Longitude from the Lizard.* °	′	″
June 9	49	35	W 33 South	64		35		53	0	53	1	21	36
10	48	55	W 26 South	91		40		81	2	14	3	25	01
11	48	27	W 19 South	83		27		78	3	32	5	22	43
12	47	45	S 31 West	48		42		25	3	57	6	00	04
13	47	19	W 32 South	49		26		41	4	38	7	00	26
14	47	13	W 10 South	37		6		36	5	14	7	53	28
15			W 5 North	58	5	0		57	6	11	9	17	26
16	47	30	W 15 North	50	12			48	6	59	10	28	26
17	47	13	W 22° 50′ S	46	0	17		42	7	41	11	30	10
18	46	43	S 23° 35′ E	33		30	13		7	21	11	11	14
19	45	22	S 9 50 East	82		81	13		7	08	10	52	14
20			South near.	104		102							
21			S 5° 30′ W	130		130		12	7	20	11	08	48
22	39	06	S 2° 50 W	144		144		8	7	28	11	19	06
23	36	55	S 10° West	133		131		23	7	51	11	47	54
24	34	42	S 5 West	134		133		12	8	03	12	02	29
25	32	55	S 9 West	109		107		17	8	20	12	22	45
26	31	06	S 9 West	110		109		17	8	37	12	42	35
27	29	27	S 6 West	100		99		10	8	47	12	54	05
28	28	50	W 34 South	67		37		55	9	42	13	57	05
29	27	12	S 36 West	134		108		78	11	01	15	25	51
30	24	56	S 6 West	136		135		14	11	15	15	41	18
July 1	22	19	South	157									
2	19	46	S 1 East	153		153		3	11	12	15	44	30
3	18	35	South	71		71			11	12			
4	16	35	South	120		120			11	12			
5	14	35	S 1° East	120		120	2	0	11	10	15	42	26
6	14	02	S 19° 15′ W	35		33		11	11	21	15	53	46
7	13	23	S 25° 30′ E	43		39	18		11	03	15	35	16
8	12	29	S 38° 50′ E	70		54	44		10	19	14	50	13
9	11	09	S 23° 15′ E	82		80	17		11	9	14	33	00
10	9	45	S 25 East	93		84	39		9	23	13	53	30
11	8	35	S 40 East	90		70	58		8	25	12	55	00

Sailing by the Arch of a Great Circle.

This though it shew the nearest way and Distance between two Places, yet cannot come so much in use as the two former kinds of Sailing, Men being either drawn from it by conveniencies of winds and streams; or else forced from it by cross winds, and Pirates, or interposition of Shoules, Islands, Headlands, &c. Nevertheless for their sakes whose Curiosity leads them to a desire of understanding this also, I shall add a few pages thereof.

If the two Places to be Sailed between, be both under the Equinoctial, the Course is directly East and West, and the Degrees Difference of Longitude tis the Distance.

If the two Places be both under one Meridian, the Course is directly North or South, and the Degrees Difference of Latitude is the Distance, unless the two Places be one in South Latitude, and the other in North, and then the Sum of the two Latitudes is the Distance.

Proposition 1.

1. Two Places one under the Equinoctial, the other in North or South Latitude, the Latitude of this latter Place, and their Difference of Longitude being given, to find their Distance on the Arch of a Great Circle, The position of the first Place from the second, and also of the second from the first.

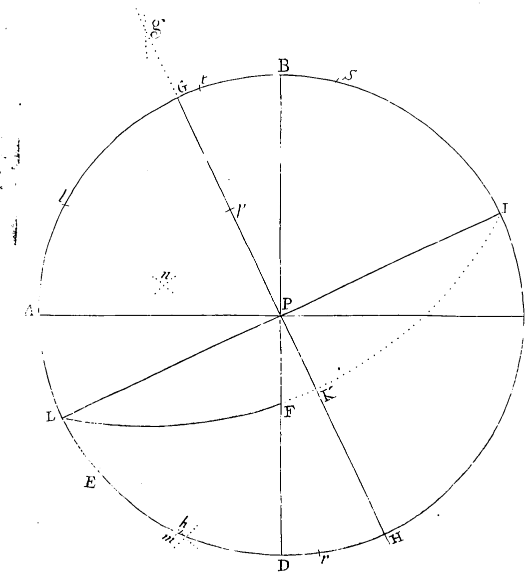
Let the Difference of Longitude between to Places be 66°, and the Latitude of that Place having Latitude 50° 00′.

Geometrically.

With the Chord of 60°, describe the Circle ABCD, which is to represent the Equinoctial, draw the Diameter AC, and at right Angles thereto the Diameter BD, from D, Prick the Difference of Longitude given 66 to L, and draw the line PL the Meridian of that Place in the Equinoctial, and the line GH at right Angles thereto.

Prick

Prick the Latitude given 50° from D to E, and laying a Ruler over C and E, find the Point F representing the Place in 50° 00′ Latitude. with any convenient extent of the Compasses, setting one foot in L, with the other make a small Arch at *m*, and another at *n*, and afterwards fixing one foot in F, with the other make two other Arches crossing the former in *m* and *n*, over which a Ruler being laid will find on the line HG produced the Point *g*. Lastly, Setting one foot in *g*, with the other describe the Circle LFI, representing the Great Circle passing over the two Places.



To

To Measure the Arch LF *which is the Great Circle Distance.*

Lay a Ruler over I and K, and thereby make on the Limb the mark *h*, then prick H *h* from L to *l*, and laying a Rular over I *l*, make the mark *p*, which is the Pole of the Arch LKI. Lastly, Laying a Rular over the points *p* and F, find the point *r*, so is L *r* the measure of the Arch L F, the Great Circle Distance.

To Measure the Angle FLD.

Which shews the Position of the place F in 50° 00′ Latitude from that at L under the Equinoctial, lay a Ruler over the points *p* and L, and make the mark *s*, the Arch *s* I is the measure of the Angle LFD.

To Measure the Angle LFD.

A Rular laid over F and *p* finds the point *t*, and the Arch A *t* is the measure of the Angle F.

Arithmetically.

In the Rightangled Spherical Triangle LDF, Rightangled at D are given the sides LD the Difference of Longitude, and FD the Latitude of the Place having Latitude, to find the Angles L and F, and side LF.

To find the Angle FLD.

DL is the Mean, and the Angle L, and side DF are adjacent extreams; Therefore,

As the Tangent of FD 50° 00′	10,076189
Is to the Radius	10,000000
So is the sine of LD 66° 00′	9,960730
	19,960730
To the Tangent of the Angle FLD 52° 32′ *equal to the Arch* SI.	9,884544

To

To find the Angle LFD.

FD is the mean, and the side LD, and Angle F are extreams adjacent; therefore,

As the Tangent of LD 66° 00′	10,351417
Is to the Radius	10,000000
So is the sine of DF 50° 00′	9,884254
	19,884254
To the Co-tangent of the Angle LFD 71° 10′ *equal to* A *t*.	9,532837

To find the side LF.

LF is the mean, and the sides LD, DF are extreams disjunct, and the mean is sought; therefore,

As the Radius	10,000000
Is to the Co-sine of LD 66° 00′	9,609313
So is the Co-sine of DF 50° 00′	9,808067
To the Co-sine of LF 74° 51′ *equal to* L *r*.	19,417380

Proposition 2.

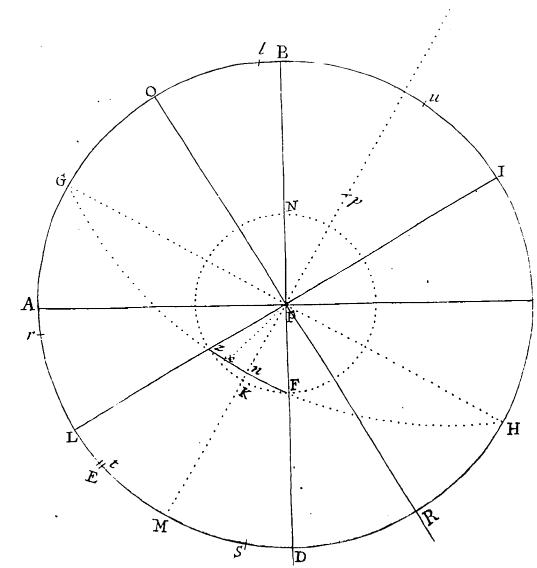
2. Two Places both in the same Parallel of Latitude, the Latitude and their Difference of Longitude being given, to find the Great Circle Distance between them, and the Angles of Position.

Admit two Places in the Parallel of 50° 00′ Differing in Longitude 60° 00′.

Geometrically.

Having described the Circle ABCD, and drawn the Diameters AC, BD at rightangles one to the other, prick 60° 00′ the Difference of Longitude from D to L, and draw LPI, and at rightangles thereto OPR. Then prick the Latitude 50° 00′ from D to E, and laying a Rular over CE, find the point F, through which describe the Parallel of Latitude FZN. Afterwards bisect the Angle LPD, draw the obscure line MP*g*, and at rightangles thereto GPH. Lastly, by two intersections as was shewed in the last Proposition, find the center *g*, and describe the Arch GZFH. ABCD represents the Equinoctial, P the Pole thereof, APC, LPI, BPD, GPH Meridians, Z one of the Places,

Places, F the other, L P the Meridian of the one Place, D P that of the other, L D or the Angle L P D the Difference of Longitude, ZF their diſtance on the Great Circle, Z K F their diſtance on the Parallel, where its very conſpicuous that the Arch of the Great Circle, paſſes nearer the Pole than the Parallel of Latitude, and n P is the Arches neareſt approach to the Pole, or Complement of its greateſt Latitude.



To find the Pole of the Arch G Z F H.

A Ruler laid over H n finds the point r, the diſtance M r pricked from G finds the point l, and a Ruler over H l finds the point p the Pole of the Arch G n H.

To meaſure the Arch Z F *the Great Circle Diſtance.*

Lay a Rular over p and both z and F, and it will find the points s t, and the ſpace s t meaſured on the Chords, is the meaſure of the Arch z n F, the Great Circle Diſtance required.

To meaſure the Angle P z F *or* P F z.

Lay a Rular over z and p, and it finds the point u, and O u is the meaſure of the Angle P z F.

To meaſure M n *the Greateſt Latitude.*

Lay a Rular over H and n, and it finds the point r as before, and M r is the meaſure of M n the greateſt Latitude, this great Circle Arch ſhall paſs through.

To find the Latitude this Arch paſſes over at every five or ten Degrees of Longitude from either z *or* F.

Take five Degrees from the Chords, prick it from L or D, drawing Meridians through each point, afterwards take 90 Degrees and prick from each of theſe points towards O, then a Ruler over each of theſe points, and the point where its correſponding Meridian cuts the Arch z F will find points towards R, whoſe Diſtance from L is the Latitude at that Longitude. But this I ſhall make plainer and clearer in the next.

Arithmetically.

In the Equicrural Spherical Triangle z P F, are given the two legs z P, F P the Co-latitude of the places you are to Sail between, and the contained Angle z P F their difference of Longitude, to find the ſide z F the Great Circle Diſtance, and Angle P z F or P F z.

For the ſide Z F *the Diſtance.*

The Meridian P n divides the Triangle Z P F, into two Rightangled Triangles in each of which, are given the Co-latitude, and $\frac{1}{2}$ Difference of Longitude: as in the Rightangled Triangle z n P is given z P the Co-latitude, and $\angle z$ P n, the half Difference of Long. to find z n the half Diſtance, in which z n is the Mean, and z P and $\angle z$ P n disjunct extreams. Therefore,

As the Radius ———————— 10,0000000

Is to the Co-sine of 50° 00' *the Latitude* ———— 9,8080675
So is the sine of 30° 00' *the half difference of Longitude* —— 9,6989700

To the sine of 18° 45' *half the side* Z F *the great Circle distance, and the whole distance is* 37° 30' *equal to* s t. } —9,5070375

For the Angle P z F *or* P F z.

In the Rightangled Triangle z *n* P, z P is the mean, and the Angles P z *n*, *n* P z are extreams adjunct; therefore,

As the Co-tangent of 30° 00' *the half difference of Longitude* — 10,2385606

Is to the Radius ———————— 10,0000000
So is the sine of 50° 00' *the Latitude* ———— 9,8842540

19,8842540
To the Co-tangent of 66° 08' *the Angle* P z *n*. ———— 9,6456934

To find the greatest Latitude.

In the Rightangled Triangle z *n* P, is given the side z P, and Angle z P *n*, the Angle z P *n* is the mean, and the sides z P, and P *n* extreams adjunct; Therefore,

As the Tangent of 50° 00' *the Latitude* ———— 10,0761865

Is to the Radius ———————— 10,0000000
So is the Co-sine of 30° 00' *the Angle* z P *n* ———— 9,9375306

19,9375306
To the Tangent of 36° 00' P *n the Complement of the greatest Latitude.* ———— } ——9,8613441

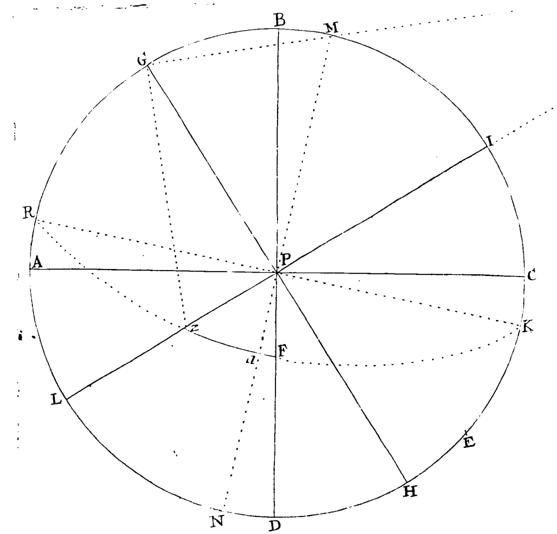
To find the Latitude the Arch passes at every five Degrees of Longitude.

Let P *x* be a Meridian at 5° Longitude from z, then in the Rightangled Triangle *x n* P is given the side *n* P, and Angle *x* P *n*, to find the side *x* P, the Co-latitude of the Arch at that Longitude, you may find alsо the side *x* z the distance to be Sailed to alter 5° of Long. and also the ∠ P *x n* the ∠ of position at that Longitude.

3. *The*

3. *The Latitudes of two places lying in the same Hemisphere, and there Difference of Longitude being given, to find the Great Circle Distance between them, and the Angles of Position.*

Let the two places be the Lizard in Latitude 50° 10' North, and *Cape Cod* in Latitude 41° 50' North, whose Difference of Longitude is about 58°.



Having described the Circle A B C D, and drawn the Diameters A C, B D, prick 58° the Difference of Longitude, from D to L, and draw the line L P, afterwards prick 50° 00', the Latitude of the Lizard from D to E, and laying a Ruler over A and E find the point F: then prick 41° 50' the other Latitude from L to *r*, and laying a Ruler over H and *r* find

the point z. Draw the obſcure line z G, and at right Angles to z G draw G *g*, which being produced, will concur with the line L I produced in *h*. Laſtly, through the three points z F *h*, deſcribe the Arch *h* z F, which will repreſent the great Circle paſſing over both places.

To meaſure the Arch z F *the great Circle diſtance, you muſt firſt find the Pole thereof thus.*

Draw the line R P K, and at right Angles thereto draw alſo M P *a* N. Then laying a Ruler over K and *a* mark *s*, and lay *s* N from R to *t*, a Ruler over K and *t* will find *p* the pole of the Arch R z *a* K. Laſtly, lay the Ruler over *p*, and both z and F, making in the Limb the marks *v w*, and the Arch *v w* is the meaſure of z F the great Circle diſtance.

To meaſure the Angles of Poſition P z F, z F P.

Lay a Ruler over *p* and z, and find the point *x*, then is *x* G the meaſure of the Angle P z F, Again the Ruler laid over *p* and F finds the point *k*, and *k* C is the meaſure of the Angle z F P.

N *s* is the greateſt Latitude the Arch paſſes. And L N is the Longitude from z of the greateſt Latitude.

To find the Latitude this Arch ſhall paſs through at every five or ten Degrees of Longitude, &c. *from either place.*

Prick ten Degrees from D to 10, and from 10 to 20, and from 20 to 30, *&c.* to L, and draw the lines 10 λ P, 20 ε P, 30 δ P, *&c.* Then take the extent between D and C, or D and A, and prick it from 10 to 1, and from 20 to 2, and from 30 to 3, *&c.* Then laying a Ruler over 1 and λ find the point *i*, ſo is *i* 10 the Latitude at ten Degrees Longitude from F, lay the Ruler over 2, ε, it finds the point *m*, and *m* 20 is the Latitude at twenty degrees Longitude from F, *&c.*

Here I might have ſhewed the meaſuring of the Angles of Poſition, at each five or ten Degrees difference of Longitude, and the diſtance that muſt be Sailed in altering each five or ten Degrees Longitude, and how to have found the difference of Longitude, and Angle of Poſition at each Degree, or half Degree difference of Latitude, or the difference of Longitude and Latitude, and diſtance made in altering the Angle of Poſition a quarter or half a point, but that we have been two large already.

The Projection here uſed is not the eaſieſt to delineat, or moſt convenient to meaſure from the diſtances, Latitudes and Angles, but conſidering that the chief uſe of this Circular Sailing is only to exerciſe Youth in Spherical Triangles, I have choſen that Projection which might repreſent the Triangles beſt, and make the thing plaineſt to view, other ways they may find in Mr. *Philips* Geometrical Seaman, and Mr. *Collins* Plain-Scale, *&c.*

Arith.

Arithmetically.

To calculate the great Circle Diſtance z F.

In the Oblique Triangle z P F is given the ſide z P 48° 10′, the Complement of the Latitude of *Cape Cod*, and the ſide F P 39° 50′ the Colatitude of the *Lizard* with the comprehended Angle z P F 58° the difference of Longitude, to find the ſide z F.

The eaſieſt way to work this is by the Verſed ſines; thus,

2) 58° 00′	*The Log. ſine of* 48° 10′	9,8722076
29 00	*The Log. ſine of* 39° 50′	9,8065575
	The double of the Log. ſine of 29° 00′	19,3711424
	The natural ſine againſt	39,0499075
	Is 1123361 *which doubled is*	2246722
48 10	*The Nat. Verſed ſine of* 8° 20′ *the difference*	
39 50	*of the ſides is*	105584
8 20	*The Verſed ſine of* 40° 7′ *the* *the diſtance ſought.*	2352306

To find the Angles of Poſition.

In the Spherical Triangle z P F are given, z P 48° 10′ the Complement of the Latitude of the Cape, the ſide z F 40° 7′ the diſtance, and the Angle z P F 58° 00′ the difference of Longitude, to find the Angle P F z.

As the ſine of the diſtance z F 40° 7′	9,8091192
Is to the ſine of its oppoſite Angle 58° 00′	9,9284205
So is the ſine of the ſide z P 48° 10′	9,8722076
	19,8006281
To the ſine of its oppoſite Angle P F z 78° 42′	9,9915089

Then for the Angle P z F; ſay,

As the ſine of the ſide z F 40° 7′	9,8091192
Is to the ſine of 58° 00′ *the oppoſite Angle*	9,9284205
So is the ſine of F P 39° 50′	9,8065575
	19,7349780
To the ſine of its oppoſite Angle 57° 28′	9,9258588

To

To find P a the Complement of the greatest Latitude this circle shall pass through.

In the Rightangled Triangle z P a, Rightangled at a, are given the side z P 48° 10′, and the Angle P z a, to find the side P a; thus,

As the Radius——————————— 10,0000000

Is to the sine of z P 48° 10′——————————— 9,8722076
So is the sine of the Angle P z a 57° 28′——————————— 9,9258588

To the sine of the side P a 38° 55′ *the Complement of the greatest Latitude.*——————— 9,7980664

Afterwards find the Angle z P a; thus,

As the Radius——————————— 10,0000000

Is to the Tangent of P a 38° 55′——————————— 9,9070773
So is the Co-tangent of z P 48° 10′——————————— 9,9518961

To the co-sine the Angle z P a 43° 43′ *which being taken from the Angle* z P F *leaves the Angle* F P a.——————— 9,8589734

To find the Latitude of this Arch, at each five or ten Degrees difference of Longitude from z, *or the Lizard, and also the position.*

From the Angle z P a take ten Degrees, and there remains the Angle β P a, then in the Rightangled Spherical Triangle β P a Rightangled at a are given the Angle β P a, and side P a, to find the side β P the Complement of the Latitude, and the Angle P β a the position.

If it were required to find the Longitude and Latitude of this Arch, at each quarter point alteration of the course.

Either by adding or subducting according as the Case requires, successively $\frac{1}{4}$ point from the Angle P z a, find the Angles P β a, P γ a, &c. and then in the Rightangled Triangle β P a, are given the side P a, and Angle P β a, to find the side β P the Complement of the Latitude, and Angle β P a the Longitude from the Perpendicular, which being compared with the Angle z P a, or F P a will give the Longitude from either z or F.

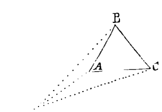
But if it were required to find the Angle of position and Longitude, at each half Degree or Degree of Latitude from either z or F.

By subtracting or adding (as the Case shall require,) 30′ or a Degree to the side z P find the side P β, then in the Rightangled Triangle β P a, will be given the sides P β, and P a to find the Angle β P a, and P β a. Here I might shew how, after you have calculated the Latitudes of the Arch at each ten, five, or single Degree of Longitude, to make pricks on the *Mercators Chart*, and to trace a Curve through them, representing the Arch of the Great Circle, &c. But I have too much swell'd the Volum already.

How to find where Currents are, and which way they set, and their rate of Driving, or Drift.

A good way to discover the great and most notable Currents, is by keeping an exact account of your way both outward, and homeward, according to your dead reckoning; being very curious in observing the way your ship makes by the Log-line, for it's not your correct account but your dead reckoning that is here to assist you. Therefore you must be careful to try how the Ship goes by it when you Sail near the Meridian, how she's drawn from her course, as again when she's steered directly East or West, take good notice if she alter her Latitude. As for those guessings by Ripplings of the water and driving of froath, &c. along the shore when in sight of it, they can stand a man but in little stead. But the most usual and useful way of observing a Current is thus;

When there's a smooth Sea and not much wind, heave out the Boat taking into her three or four hands, a Compass, Log-line, and half-minute Glass, with a line or small warp of above an hundred Fathoms long, to the end of which line fasten a Triangular piece of board as the board A B C, and to one of the Angles fasten a good weight of Lead to sink it, some use instead of this board a Kettle tied by the bail. When you are off from the Ship, cast over your board or Kettle letting it sink at least 60 Fathom, and if you have line enough let it go 100 or 120 Fathom, then belaying the line fast about her stem, it will bring her up and make her ride as if at an Anchor.



Then cast over your Log, turn up the Glass, and as you veer out the Log-line, set the drift of the Log with your Compass, so shall you know whether there be any Current or not; and if any how it sets, and the rate of driving, remembring to add always to the drift, if the line she ride by be sixty Fathom $\frac{1}{3}$ part, if the line be 80 Fathom $\frac{1}{4}$, if an hundred Fathom

Fathom the $\frac{1}{5}$ *th* part, *&c.* of the drift more for the drift of the Boat: for tho the Boat ſeem to ride or lie ſtill, yet ſhe's found by experience to drive the mean time, but whether theſe allowances be the very truth I ſhall not much contend, they are delivered as agreeing with experience, and therefore may be uſed till farther experience better informs. Yet note that the bigger the weight and board is that the Boat is to be rid by, the leſs will be her drift.

Of Lee-way.

That you may be the better able to judge of a Ships *Lee-way*, always when you are by a wind and have Land in ſight juſt on head, take notice as you keep the Ship ſteered on the point the Land bore on, how ſhe ſlides away to *Lee-ward*, and the Land appears ſtill more and more to windward, for by ſuch kind of Obſervations taking notice of the Sail abroad, ſtreſs of wind, Ships trim, and growth of the Sea, the Judgment may be ſo ſtrengthened that a man ſhall rarely fail in giving a pretty true allowance.

If the Land in ſight be not right on head, yet by taking notice of the point it was on at firſt, and how it weathers in keeping the ſame courſe, you have the ſame advantage.

FINIS.

THE DOCTRINE OF THE SPHERE;

Grounded on the Motion of the

EARTH,

And the Antient

PYTHAGOREAN or *COPERNICAN* SYSTEM OF THE

WORLD.

IN TWO PARTS.

LONDON:

Printed by *A. Godbid* and *J. Playford*, in the Year 1680.

THE PREFACE.

WHAT the Reader is like to meet with in the following Treatiſe, the Contents will inform him, what occaſioned the writing of it I have intimated in the firſt *Section*; I have farther to add, that I thought I could not perform any piece of Service, which might more juſtly deſerve acceptance, or be more uſefull to the Ingenious Student of *Aſtronomy* than this, wherein I have ſhewed him how all the Diurnal Appearances of the Sun and Stars are naturally made, and how laying aſide all *thoſe Old Projections* of the *Sphere*, which falſly ſuppoſe the Earths *Stability*, they may be repreſented, and the Problems concerning them anſwered by *New ones*, grounded on that true Syſtem of the World, which

ſuppoſes the Annual and Diurnal Motions of the Earth, propoſed firſt by *Pythagoras*, aſſerted by *Copernicus*, demonſtrated by *Kepler*, and as moſt agreeable to reaſon and experience approved and entertained by the ableſt *Aſtronomers* of our Times.

Hence I have given it the Name of *the Doctrine of the Sphere*, wherein if my Reader ſhall think I have anſwered but few of thoſe many Problems that may be propoſed, I muſt tell him, that though I have handled only the moſt ordinary and uſeful, yet if (as I ſuppoſe) he underſtands the Nature of Projections, and the Reſolution of *Spherical Triangles*; he will readily apprehend how other Circles may be drawn in that I have deſcribed, and more Triangles formed, whence anſwers may be given to any Problem concerning the *Phainomena* of the Sun or Stars, as eaſily as by any of the Ptolemaick Projections hitherto uſed and Taught.

And leaſt what I have writ ſhould prove uſeleſs to him for want of ſuch a perfect knowledge in *Trigonometry*, I have laid down the Analyſis or Canon, whereby every particular Problem is anſwered in words at length, for I know very well there are a ſort of diligent and curious Men in the World, who tho they may not at firſt apprehend the reaſon of a Rule, yet having frequent occaſion to employ it, may at length make themſelves Maſters of it, and to ſuch works of this Nature prove generally the moſt uſefull.

For whoſe ſake I have followed the ſame plain Method in the *Second Part*, where I have Taught how to find within what ſpace on the Earth the Solar Eclipſe is viſible, and where the principal *Phaſes* appear, by Calculation; as alſo how all the requiſites of the ſame

Eclipſe

Eclipſe may be found, for any given place, without the Calculation of *Parallaxes*; which uſeful Invention having never appeared in Publick before, I find my ſelf obliged to give the following account of its Original, that I may not hereafter be accuſed of injuſtice to two of my ſingular kind Friends, the admirably Ingenious Sir *Chriſtopher Wren*, (Maſter Surveyor of His MAJESTIES Buildings) and our Southern *Tycho*, Mr *Edmond Halley*.

It was in the *Winter* of the year 1676. that I light upon this Method; The Autumn before ſome ſpots had appeared in the Sun, and then I was obſerving a Compact one that made more than two entire Revolutions before it was wholly extinct; Examining my Obſervations to find the Reaſon of their different Appearances, I collected from them, that the ſpots adhered to his Superficies, and that they were carried round his Center once in 25 days and a quarter, the Northern half of that Axis on which this Revolution was performed, being inclined about 8 *Deg*. to the plane of the Ecliptick, betwixt the 12th and 18th Degrees of *Virgo*, which being concluded, I found that allowing what alterations muſt neceſſarily happen in their Appearances, by reaſon of the Earths Diurnal Progreſs in her Orbit, all my Obſervations would be repreſented as nearly as I could expect. And now having ſeen how the Poles, Axis, Equator, and Parallels in the Sun altered their Appearances to the Eye placed on the Earth, according as ſhe changed her place in her Orbit, this put me upon conſidering how the Axis of the Earth, and the ſeveral Paths, or Parallels imagined on it, would appear from the Sun, and how the Diurnal *Phænomena*

would

would be repreſented by an *Orthographical* Projection of our Globe, on a Plane ſtanding at Right-Angles to the Ecliptick, and the Line connecting the Centers of the Sun and Earth: Here I found what I have delivered in the firſt *Section* of the Second Part of this Treatiſe, *viz.* how the Parallaxes of Altitude, Longitude, and Latitude, were made, and given by Conſtruction, and upon a little farther Conſideration, how the Times of any Appearance of a Solar Eclipſe, the parts then darkned, with the Inclinations of the Cuſps might be determined, without any Calculation of them, by the help of ſuch a Projection. Much pleaſed with this diſcovery, I immediately conſtructed an Eclipſe I had obſerved at *Derby*, *Octob.* 25. 1668. and with a brief Deſcription of the Method tranſmitted it to my kind Friend, and then Living Patron Sir *Jonas Moore*, by whom it was Communicated to the Royal Society at one of their Meetings; It hap'ned Sir *Chriſtopher Wren* was there preſent, who having viewed the Figure only, told him, that himſelf had known the ſame Method 16 years a gone, and to aſſure him of it, ſent him ſoon after a like Projection neatly drawn on Paſtboard, and fitted with ſeveral Ingenious contrivances of Numbers and Scales for the Conſtruction of Solar Eclipſes in our Latitude. This Sir *Jonas* brought down to me, then Labouring under ſome Diſtempers, to *Greenwich*, whereby I was ſatisfied that the honour of the firſt Diſcovery of this uſeful invention was abſolutely due to Sir *Chriſtopher Wren*, whom of all Mortals I believe to have been the firſt, that knew how to find the Times of the Beginning, Middle, Digits then darkned, Inclination of the Cuſps at any Phaſis, and End of a Solar Eclipſe, without the Calculation of Parallaxes.

In

In ſome Diſcourſe I had with Mr. *Halley*, before he went to obſerve the Southern Conſtellations at St. *Hellena*, he Mentioned the Conſtruction of Eclipſes as poſſible, but out of a tender Affection to his own Inventions, or for what other Reaſon I know not, he was pleaſed to conceal his Method both from me, who then thought it ſcarce poſſible, and, for ought I can underſtand, from all others: Nor is it to be wondred at, that three of us ſhould make this diſcovery ſeverally, and without any Intimation of the Method from each other; For to me it ſeems very unlikely, that any one who admits the Motion of the Earth, and apprehends how the Moon paſſing betwixt the Sun and it, Eclipſes ſome part of him to all thoſe People who lie under its paſſage, ſhould ever miſs of it. But we might rather admire, (had I not intimated the Reaſon of it in the fifth *Section* of the Second Part) that the acute Wit of the Sagacious *Kepler* ſhould over look it, when he had diſcovered the Method of finding by Calculation within what ſpaces on our Globe the Solar Eclipſe is bounded, and where the principal *Phaſes* of it would appear.

I had almoſt finiſhed what I have here delivered concerning the Conſtruction of Eclipſes, when it was intimated to me by my kind and Ingenious Freind Mr. *Perkins*, that there was little extant in the *Engliſh* Tongue concerning the general Method of Calculation aforementioned, and that therefore I might do well to explain it. I conſidered then that this might be performed more eaſily than is Taught by the firſt famous Inventer, and without his Nonageſſimary Table. Waving therefore my firſt intent, which was not to engage my ſelf in any thing, that had been expreſly handled by

others

others before me; I thought it neceſſary to impoſe this farther task on my ſelf, and accordingly wrote the precepts relating to that Subject, after, tho for Method ſake, they are inſerted before the Conſtruction of the Solar Eclipſe.

In the year 1670. I firſt publiſhed Predictions of the Moons Appulſes to Fixed Stars, which I continued Eight years after ſucceſſively, firſt in the *Philoſophical Tranſactions*, after in the *Royal Almanack*, propoſing them as an uſeful and the moſt practicable expedient for finding the *Longitude*, or difference of Meridians betwixt any two places, by reaſon both of their frequency, and that a ſingle Perſon might obtain what ever is required in Obſervations of them with a ſmall *Apparatus* of Inſtruments, but the Calculation of Parallaxes required in their Application cauſed them to be leſs regarded then I hoped they would have been; I have therefore ſhewn here how this tedious labour may be avoided, and the Occultation or Emerſion of a Star from the Moon, or the Time of its viſible Conjunction with her Center, and diſtance then from her next Limb may be found by Conſtruction, as the *Phaſes* of a Solar Eclipſe; and the difference of Meridians betwixt two diſtant places, by Obſervations of the ſame Appulſe made at each; and now the main difficulty being removed, I would again recommend this Method to the Study and Practice of the Ingenious *Aſtronomer* and *Navigator*.

Whom I adviſe to make himſelf well acquainted with the firſt part of this following Work, if he intends throughly to underſtand the ſecond, wherein the Method of Conſtructing Eclipſes and Appulſes is Taught. And to carry this Notion along with him, which I forgot to inſert in his proper place, *That by the true diſtance of the Sun or a Star from the Vertex*, I mean *an Arch in the Earths*

Earths ſuperficies intercepted betwixt two Lines produced from its Center, the one to the ſtation of the Obſerver, or Vertex, the other to the Sun or Star. Something may after appear difficult, eſpecially to ſuch Young Artiſts, as this piece is properly deſign'd to Inſtruct, though I have endeavoured to be as plain as was poſſible; but where there are ſuch able Maſters as Mr. *Perkins* to explicate them, ſome little difficulties will be found rather an advantage, than otherways to the Student.

The aforementioned Predictions of Appulſes gave occaſion to my firſt acquaintance with Sir *Jonas Moore*, who well apprehending their uſe, and that good Obſervations of the Moons Motions conſtantly continued for ſome years, and an accurate Catalogue of the Fixed Stars were required, before this eaſy Method was to be applyed, was pleaſed to recommend me for that Work to his MAJESTY, who has ſo far encouraged it by his Liberal allowance, that we need not doubt but what is wanting may be obtained in reaſonable Time. And now Sir *Jonas* having left a Book of *Navigation* in the Preſs, by reaſon of his ſudden Deceaſe, unperfect; I thought I could not at preſent better anſwer the Engagements I lie under to my Royal, and moſt Gracious Maſter, than by imparting to the Publick an Invention, which through his Favour and Princely Care may become of ample uſe to it, in a piece deſigned by the Author for his peculiar ſervice. In doing of which I hope I may be allowed to have ſatisfied the intereſt of that debt of Gratitude I owe his Memory, and that the diſcharge of the Principal will be Reſpited, till ſuch time as Providence ſhall enable me with a more proper occaſion, which I hope may be e're long.

THE CONTENTS.

PART I.

How

PART II.

To

The remoteness of my habitation from the Press, has been the principal accsion of the following *ERRATA*, which the Reader is advised to Correct before he proceed any further.

PAge 1. Line 19. for *Contiguation*, read *Contignation*. p. 2. l. 23. for *Chartes*, read *Cartes*. p. 3. l. 15. for *Vertex*, read *Vortex*. l. 26. for *Declination*, read *Delineation*. p. 4. l. 45. for *P e*, read *P C e*. p. 9. l. 15. for *q T a u*, read *q T w*. l. 28. for *the place*, read *that place*. p. 10. l. 12. for *c s*, ♋ *o*, read *c, t* ♋ ⊙. p. 11. l. 1. for *s, o P*, read *s*, ⊙ ♋. l. 10. for *Chapter*, read *Section*. p. 17. l. 5. for $\frac{1}{2}$ *c s*, read $\frac{1}{2}$ = *c s*. pag. 18. l. 32. for ♈ ♏ ♎, read ♈ ♓ ♎. p. 20. l. 31. *put the Comma after* e; l. 34. for *N*, read θ *N*. p. 24. l. 5. for *by Copernicans*, read *by the Copernicans*. p. 27. l. 7. for *Phaces*, read *Phases*. p. 30. l. 1. for *H*, read *r*. l. 3. for *h*, read *H*. p. 31. l. 31. for *T* ☉, read *T o*. p. 33. l. 8. for ⊙ *c T*, read *o C* ♈. p. 35. l. 5. for *Added or*, read *Added to, or*: p. 40. l. 39. for *Solar shadow*, read *Solar, of the shadow*. p. 45. l. 25. *Blot out the Comma after Diameter*. l. 32. for *happens*, read *appears*. p. 46. l. 8. for *makes*, read *it makes*. p. 47. l. 15. for *Disk she*, read *Disk when she*. p. 48. l. 10. for *that Path*, read *the Path*. p. 50. l. 1. for *the Latitude*, read *that Latitude*. p. 58. l. 34. for λ, read ω. p. 59. l. 1. for *s*, read χ. p. 72. l. 14. *after Parallax add*, + *the Suns*. p. 74. l. 41. for *of Greenwich*, read *at Greenwich*.

Errors to be amended in the Tables. Pag. 80. *against Feb.* 2. for 1ˢ 2° 31′ 25″, read 1 02 31 35. p. 81. *against Aug.* 4. f. 7 02 33 59, r. 7 02 53 59. p. 86. *against Feb.* 12. f. 2 16 47. r. 2 16 37. *and against Feb.* 13. f. 2 19 08, r. 2 19 48. p. 88. *against May* 19. f. 1 01 38 08, r. 1 01 31 08. *and against May* 15. f. 15 02 34, r. 15 02 24. *and against May* 11. f. 6 56 18, r. 6 56 14. p. 90. 4th *Column after Octob.* 28. *put in* 29 30 31. *and against* 30. *for* 11 02 25 35, r. 11 02 26 51. p. 94. *against* 29. Deg. f. 59783, r. 49783. *and against* 30. f. 59429, r. 49429. p. 97. *against* 5, 23. f. 0 49 30, r. 0 49 40. p. 104. *against year* 1. f. 6 23 31 29, r. 6 24 35 29. *and against* 2 *days* f. 1 24 22 53, r. 0 24 22 53.

THE

THE DOCTRINE OF THE SPHERE.

SECTION I.

THose who have converſed with Antiquity will eaſily allow the *Pythagorean* Syſtem of the World, lately revived by *Copernicus*, to have been Compoſed long before the *Ariſtotelian*; which though it had the Fortune to be more generally entertained, and to be adorned with very ſpecious Explications by *Ptolemy* and his Followers, will force who ever ſhall go about to defend it, on ſuch Aſſertions, as no ingenuous man could ever conceive to be reaſonable: For what perſon who has been ſo far acquainted with Aſtronomical Demonſtrations, as to underſtand how vaſtly bigger then our Earth, not only the Sun, but ſome of the Planets alſo are, how immenſly diſtant from us the fixed Stars are placed, and that ſome of them are probably bigger than the Sun it ſelf? What man. I ſay, thus informed, could ever conceive that all this great Contiguation ſhould be thrown about ſo ſlender a Ball as our Earth is,

compared with them, once in Four and twenty Hours? which the *Aristotelians* are forced to affirm. And how could it sink into the conception of a considerate man, that Nature or the unrestrained Architect of the Heavens should contrive *Epicycles* and contrary Motions to carry about the same Body, as they are likewise obliged to assert, when whatever is to be performed by them, might much more easily be effected by one continual progressive Motion of each Planet in a simple Line, as is abundantly proved in the Works of the Learned *Kepler*, and by the near agreement of his Tables with Celestial Observations, whilst the Planets places calculated from the best Numbers extant, grounded on the *Ptolemaick Hypotheses*, are found as wide and different from their observed Positions, as that *System* is from the *Copernican?*

The Noble *Tycho* proposed a third *System*, which as a Mean betwixt these, he thought might find the easier entertainment in the World: In this he admitted the Diurnal Rotation of the Earth about her *Axis*, whereby he avoided the imputation of that absurd Opinion, That the Sun, and with him all the Planets and fixed Stars were carried round her once a day; but the Sun and all the other Planets, save the Moon, moving round him, he supposed carried about the Earth once in a year. By this contrivance he conceived he attributed less Motion to the Earth than the *Copernicans*; and that nevertheless the appearances of the Planets would be represented, as in that *Hypothesis*: But if we may admit the Philosophy of the very ingenious *De Chartes*, it will be found, the Motion he allows the Earth is not less, but as much or more than the *Copernicans* require; and it seems little less difficult to conceive, that the vast Bodies of the Sun and Planets should be carried about it Annually, than Diurnally. However this Opinion has found but very few Followers, those who with *Aristotle* and his Disciples deny the Motion of the Earth, being unwilling to grant so much, as the noble Restorer of *Astronomy* required; and those who, with *Pythagoras* and his *Sectators* the *Copernicans*, admit it, thinking it no less necessary to assert the Annual, than the Diurnal.

But the great and many Discoveries which have been made in the Heavens by the means of the *Telescope*, invented some few years after the decease of this Famous and never enough commended Great Person, have put an end to the Controversie in the opinion of all ingenuous and unprejudiced Judgments, by affording us near as many Arguments for the Earths Motion, as they are in Number. It would require an intire Volume to give an account of all, and what may be inferred from them: I am obliged to brevity, and shall therefore mention no more but the following. The Planet ♃ is allowed by all Astronomers to be carried round the Heavens once in Twelve years, though he be very considerably larger then our Globe of Earth; and when nearest, five times more remote than it from the Sun: This Planet nevertheless is found by undubitable Observations, to turn about his own *Axis* once in some little less than Ten Hours, which I conceive so plain an Argument, both for the Annual and Diurnal Motion of the Earth, that the *Copernicans* need not

not seek any other, till their Antagonists shall produce a better for its stability.

How the Annual appearances of the Planets, their accelerate and retarded Motions, the augmentation and decrease of their visible Magnitudes, together with their Stations, and Retrogradations, are formed in the *Pythagorean* or *Copernican System*, has been abundantly shewed us by those many Learned Persons, who have framed Astronomical Tables on it, for calculating the Planets Places in the Heavens: But how the Diurnal are made out, none that I know of, hath fully informed us. Having therefore obliged my self by promise to the Relations of my deceased kind Friend, the great Encourager of my Studies, and the Author of the foregoing Work, to write an Explication of the *Phainomena* of the *Globe*, which was wanting in it: I shall ground it on that oldest and true *System*, which asserts the Sun to be placed in the Center of our *Vertex*, and all the Planetary Motions (having none proper to himself, besides a *Rotation* about his own *Axis* once in 25 days 9 hours nearly) and then,

1. That the Earth is carried round the Sun in a large Path, betwixt the Orbs of ♂ and ♀ once in a year.
2. That besides this Annual Motion, she turns round her own *Axis* once in 24 hours.
3. That the said *Axis* is constantly inclined to the Plane of the Orb at the same Angle, and keeps in all parts of the same Revolution, nearly parallel to it self.

These Assertions being the ground on which the following Discourses are founded, it will be convenient to explicate them by a Plane Declination; in doing of which, I shall also take occasion to explain some terms, whereof I shall make frequent use hereafter.

SECTION II.

IN the uppermost of the two first Figures, let ☉ represent the *Sun* placed near the Center of the Annual Orb ABCD, in the *Periphery* of which the Earths Center is carried round him once a year, according to the Succession of the Signs. The Ancients, and all before the Sagacious *Kepler*, supposed this a perfect *Circle*, but he proves it to be an *Ellipsis*, the remotest end of whose longer or transverse Diameter, is Eight Signs, and nearly as many Degrees elongated from the first Star of ♈, and having the Sun in one of its focal Points.

Through ☉ the Sun draws the Line ♈ ☉ ♎, this I call the *Equinoctial Colure*; and at right Angles to it, also through the Sun ♋ ☉ ♑, this I term the *Solstitial Colure*.

On the Centers *e* where these Lines intersect the Annual Orb, describe the four lesser Circles *d o t e*: these may represent the places of the Earths

 Globe,

Globe, on its four Cardinal Points; and if through *e* in each of these, the Lines *d t*, be drawn at right Angles to ⊙ *e*, these shall determine the illuminate part of the Diske *d i t*, from the obscure *d o t*; wherefore I term the Lines *d e t*, *the Horizon of the Diske*.

If the plane of the Annual Orb ABCD, be supposed produced from the Sun infinitely every way, it will describe amongst the fixed Stars that Line we call the Ecliptick: And if in any place of the Orb, the Eye be supposed, somewhere in the inferior Hemisphere of the Earth, perpendicular to the Ecliptick, over her Center, then shall the utmost Circle of the Earths superior Hemisphere *d o t i*, lye in the same plane; and therefore I call it the *Ecliptick on the Earths Globe*, or, when I have no occasion to consider the Annual Orb, simply the *Ecliptick*; and its Center *e*, the *Center of the Ecliptick*.

To the Eye thus placed, the Northern Pole of the Globe, or the upper Extremity of that Axis, about which her diurnal Revolutions are made, will appear at P 23° 29′ distant from the Pole of the Ecliptick, to which if it be joyned by the Line P *e*, this shall represent the constant distance of the two Poles, or the inclination of the Axes of the Globe and Ecliptick to each other; we may call it *the Line of the Direction of the Earths Axis*.

Let this Line be produced each way till it intersect the Ecliptick on both sides; so have you that Line in the Diske, I call the *Solstitial Colure*; because when ever the direct Rays proceeding from the *Sun's* towards the *Earth's* Center, run parallel to this Line, that is, when the Earths Center shall be found in the *Great Solstitial Colure* ♋ ⊙ ♑ before described, the longest or shortest Days are made in all places on it.

This Line of Direction P *e* is found allways parallel to the *Great Solstitial Colure* ♋ ⊙ ♑, and nearly to it self where ever the Earth is found in her Orbit, durcing the space of *one Annual Revolution*.

That Line which stands at right Angles to the Line of direction on the Center *e*, we may call the *Earths Equinoctial Colure*; because it keeps always parallel to the great Equinoctial Colure before described, and when ever the Suns Centrall Rays incede directly parallel to it, the Days and Nights are equall in all places: And this also happens when the Earths Center arrives at the Points, where the *Great Equinoctial Colure* intersects the Orbit.

The Inclination of the Axis will be best apprehended by the under Figure, in which the Line CDCC, may represent the great Orb, viewed by the Eye from an infinite distance, some little elevated above its plane ♈ ♋ ♎ ♑, the Earths positions in it on the four Cardinal points, *e* the Pole of the Ecliptick, *e d* its Axis, always perpendicular to the great Orb, over the Earths Center, P the North Pole of the World, P *m* its Axis, about which the diurnal revolutions are made from West to East, keeping in all parts and places of the Orbit during one revolution, nearly parallel to its self; the Angle of its inclination to the Axis of the Ecliptick P *e* being constantly 23° 29′, and for ought we can collect from the ancienteft Celestial observations, remaining in all Ages invariable.

Every

Every Point in the Globe as it turns round upon its Axis describes a Circle in the Diske about the next Pole, which I call *the Path of the Vertex*, considering the said Point as Vertical to the Earths Center: its uses being the same with that we call the Zenith, or Vertex, in the *Ptolemaick* projections.

Imagin a great Circle compassing the Earth equally distant from both its Poles, this shall be the *Equator*, the distance of any place from it the *Latitude of that Place*, and therefore the *Semidiameter of the Path* equal to the *Complement of the Latitude*.

If a Circle be imagined to pass through any place in the Earths superficies, and the two Poles, on which it turns, that Circle shall be the *Meridian of that place*; and that part of it which lies from the said place towards the North Pole, will be the *North part of the Meridian*; toward the South Pole, *the South Part*.

That Point in the Earths Periphery opposite to the Sun, or lying in a straight Line produced through the Centers of the Sun and Earth, I call *the Suns place in the Ecliptick*. And now seeing we shall have no farther use of the great Orb at present, I shall wave the mention of it; and when I shall have shewed how the Meridian, and *Path* of any *Vertex* in the Globe may be projected, the Eye being supposed in the Southern Pole of the Ecliptick; I shall next shew how from this Point, Spherical Triangles will be formed, wherein there will be sufficient given for determining the usual requisites of the Sphere, by the known Resolutions of Trigonometry.

SECTION III.

THE Meridians in those lesser projections of the Globe, which are placed in the Periphery of the Annual Orb in the first Figure, are described as the hour Circles in that Stereographical projection of the Sphere on the Plane of the Horizon, where the Latitude is equal to the Complement of the Distance of the two Poles of the Globe and Ecliptick; that is thus, make the Semidiameter of the Earths Diske equal to the Tangent of 45 Degrees, or Semitangent of 90, and having drawn the Solstitial Colure, set off in it the Tangent of 11° 44′ ½, or Semitangent of 23° 29′, the distance of the Poles of the Globe and the Ecliptick, from the Center *e* to P; that shall be the place of the Pole of the Globe.

Take the Tangent of 66° 31′, the Complement of the distance of the two Poles, and set it off likewise in the Solstitial Colure produced the contrary way, without the Diske, from *e* to *T*, this shall be the Center of the *first Meridian*.

All the Meridians on the Earth pass through its Poles, extend therefore the Compasses from T to P, and through it strike the Arch ♈ P ♎ in the third Figure; this shall represent the said *first Meridian*.

To

To find the Centers of all the rest, through T draw *q T w* at right Angles to the Solstitial Colure produced, and making T P the Radius of a Tangent Line, therewith divide the said Line both ways from T.

Fig. 3. Count 15, 30, 45, 60, 75 Degrees in the said Line both ways from T, so have you the Centers of ten other Meridians, upon each of which, if you set one Foot of the Compasses, and extending the other to the Pole P, therewith describe Circles through it, these shall represent so many Meridians, each one hour distant from other, or the Hour-circles, the Earth being in the first Point of ♈ or ♎, and viewing the Sun in the opposite Point.

The last of these ♋ P ♑ coincedes with the Solstitial Colure, and is a streight Line, its Semidiameter the Tangent of 90 Degrees being infinite.

Every place or Point on the Globe, as I said before, describes a Circle about its Axis, which I call the *Path of the Vertex*: Let it be now required to delineate the Line, that *London* carried round the Axis describes on the Plane of the Ecliptick, to the Eye placed in its Southern Pole.

The distance of *London* from the Pole of the World is 38° 29′, and of the Pole of the World from the Pole of the Ecliptick 23° 29′: Let now in the third Figure ♈ ♋ ♎ ♑ represent the Periphery or Diske of the Earth lying in the Plane of the Ecliptick, *e* the Pole of the Ecliptick, ♋ P *e* ♑ the Solstitial Colure, ♈ *e* ♎ the Equinoctial Colure, P the Pole of the Globe, set off in it according to the former directions.

To the distance of the Poles P *e* 23° 29′, add 38° 29′, the distance of *London* from the North Pole of the Globe, the Sum 61° 58′ is the greatest distance of *London* from the Pole of the Ecliptick.

Make the Radius of the Diske equal to the Tangent of 45 Degrees, or Semitangent of 90; and from the same Line of Tangents, set off the Tangent 30° 59′, or Semitangent of 61° 58′ from *e* the Pole of the Ecliptick, towards ♋ to *m*, in that Point the Path shall cut the Colure; or counting the said 61° 58′, from ♈ towards ♋ to M, in the Ecliptick, lay a Ruler over the opposite Point ♎ and this Point M, it will cut the Colure in *m*, where the Path shall likewise intersect it.

Subtract the distance of the two Poles *e* P 23° 29′, from the Complement of the Latitude 38° 29′, the Difference 15° 00′, is the nearest approach of the Path of the Vertex to the Pole of the Ecliptick.

From the forementioned Line of Semitangents, set off the said 15° 00′ from *e* towards ♑, to *x*, or counting the said distance from ♈ towards ♑ to X, lay a Ruler over X and ♎, it will cut the Solstitial Colure in the said Point *x*, where it is intersected by the Path.

The Middle betwixt these Points *m* and *x*, shall be the Center, upon which if you strike a Circle through them, it shall be that Line I call the *Path of the Vertex*, or which *London* would appear to describe on the Plane of the Ecliptick, to the Eye placed in the Southern Pole, as the Earth turns round, if the Globe were diaphanous.

After

After this manner were the Paths described in the small Projections placed in the Periphery of the first Figure, of which the remotest represents one half of the *Equator*, or of the Paths of such places as lie under it, that within this, the *Northern Tropick*, or the intire *Path* of such places as lie in the Latitude of 23° 29′ North: the next within this is the Path of *London*, or of any place equally distant from the North Pole of the Globe: the innermost, of such places as lie 23° 29′ distant from the said Pole, which therefore we may call the *Artick Circle*.

Whereby it will be easily conceived, why under the Equator the Days are equal at all times of the year; why the Days at the same time of the year are not of the same length in all places, why within the Artick Circle they are sometimes longer than 24 hours, and at the opposite times of the year the Nights as long; but when the Earth transits the first Points of ♎ and ♈, the Days and Nights are in all places equal.

For the Sun illuminates but one half of the Earths Globe by his Central Rays, and if the Earth be supposed at ♎ or ♈, the *Horizon of the Diske ted* coincedes with the *Solstitial Colure*; and of all the Paths which can be projected within the Ecliptick, on the Globe, according to the foregoing precepts, the one half will fall in the illuminate, the other in the obscure part of the Diske. Now whilst the *Vertex* is traversing the illuminate part, it sees the Sun, and we call it *Day*; whilst it travels through the obscure, we see him not, tis *Night* to us; and since in both these positions of the Globe, the obscure parts of all the *Paths*, or the *Nocturnal Arches*, will be equal to the illuminate, or *Diurnal Arches*, the days must of necessity be equal to the Nights in all places.

Conceive the Globe to have moved from ♎ to ♑, *the Line of Direction*, (keeping its *parallelisme* to its self, and the *great Solstitial Colure*) now coincedes with it, and the Rays of the Sun illuminating the Hemisphere; and the Horizon of the Diske stands at right Angles to it, on the Pole of the Ecliptick *e*: Here all places betwixt the two Poles of the Globe, and Ecliptick, or within the Artick Circle, are illuminated in their whole Revolutions. Wherefore the *Vertexes* see the Sun longer than 24 hours, more or less according as they are less or more distant from the Pole of the Globe, but those which lie under the Artick Circle touch the Horizon of the Diske; and therefore at this time see the Sun, not only in the South, but also in the North part of the Meridian, 90 Degrees from the Vertex, or precisely in the Horizon, and as soon as he is past it, view him rising again.

All the *Paths*, without this, intersect the Horizon of the Diske; whereby the *Day* is made so much longer than the Night, as the part of the Path lying in the *Illuminate Hemisphere*, is more than that part of it which lies in the *obscure*: *v z l* represents the *Path of London*, in which the *Vertex* cuts the *Horizon of the Diske*, some little more than 8 hours before it transits the *Meridian*, or Line passing from the Pole to the Sun, and tis so long again ere it pass the Horizon into the obscure Hemisphere; thereby shewing the *Day* to be something longer than 16 hours, and therefore the *Night* at this time scarce eight.

Whilst

Whilst the Earth runs from ♎ by ♑ to ♈, the *Northern Pole* will be always in the illuminate part of the Diske, thereby shewing that it is continual Day all that time under the said Pole, but whilst she runs from ♈ by ♋ to ♎, it will lie in the obscure part, thereby shewing it continually Night in the same place; the South Pole in the mean time passing in the illuminate Diske, and enjoying the Day, as it did the Night continually whilst the North Pole was illuminate: So that *under the Poles, the whole year consists but of one long Day, and Night.*

When the Earth is at ♋, whence the Sun appears in ♑, the length of the Night will be equal to the length of the Day when the Earth was on the opposite Point; for the *Nocturnal Arch*, or obscure part of the Path, is here equal to the illuminate, or *Diurnal*, when the Globe was at ♑, and the illuminate here no more than the obscure in that place.

When the Earth is at ♑, the *Tropical Path* will just touch the Ecliptick in the Meridian, or that point of the illuminate Diske, which is directly opposite to the Sun, thereby shewing, that when ever the Earth arrives at that Point of her Orbit, the Meridional Sun will be vertical to all places in that Latitude of 23° 29′ North, the length of the Day here appears by the Projection; for the illuminate part of the Path betwixt the Horizon and Meridian being something less than 7 hours, the intire Day must be something less then its double, or 14 hours, and therefore the Night above 10 hours.

But to those People who live upon the Equator, the one half of the Path will always fall in the illuminate part of the Diske, the other in the obscure; to whom therefore at all times of the year, the Days and Nights will be equal.

How the Paths lie that have the same Latitude South of the *Equator*, will be easily seen, if the first Figure be held before a Looking Glass, and its Picture viewed in it; or they may be projected *in plano*, if ♋ be wrote where ♑ is, ♈ where ♎, &c. in the great Orb, and the Pole of the World laid down on the contrary side, or to the right hand, from the Pole of the Ecliptick: I shall not need therefore to repeat any directions for this purpose, but only to shew how such further Lines as shall be found necessary for my business in hand, may be described, and how the common requisites of the Sphere may be investigated by them.

SECTION IV.

THE first thing supposed to be known in all Problems concerning the diurnal *Phænomena*, is the distance betwixt the two Poles of the Globe and Ecliptick; this I have before proposed 23°29′.

The next is the *Suns* place, or the Longitude of the Point in the Earths Diske opposite to him, from the next Equinoctial Point. And these being given, the requisites demanded are of two sorts; General,

or

or Particular, the General are such as are the same to all the inhabitants of the Globe, at the same time, as

1. The distance of the Suns place from the North Pole of the Globe.
2. The right Ascension of the said place.
3. The Angle which the Meridian passing through it makes with the Ecliptick.

The Particular are such as are different at the same time in different Latitudes, such are the Amplitudes, and Ascensional Differences, &c. which require the knowledg of the ☉s distance from the Pole, to limit them. I shall therefore first shew how the General requisites may be represented and determined, supposing the ☉s place in 15 Degrees of ♉, or 45 Degrees distant from the first Point of ♈.

In the third Figure, let ♈ ♋ ♎ ♑ represent the Ecliptick, *e* its Pole, ♋ *e* ♑ the Solstitial, ♈ *e* ♎ the Equinoctial Colure, P the North Pole of the Globe, ♈ P ♎ the first Meridian described, and *q T a v*, the Tangent Line passing through its Center, divided according to the Prescriptions of the foregoing Chapter. Fig. 3.

Count 45 Degrees, the ☉s distance from the Equinoctial, from ♈ towards ♋ to ☉, through which and the Pole of the Ecliptick *e*, draw the *Line of the Suns Longitude* ☉ *e n*, producing it till it intersect the Tangent Line in *q*.

Through *e* draw H *e r*, at right Angles to ☉*e n*, this shall be *the Horizon of the Diske* to this place of the Sun, beyond which produce it likewise, till it intersect the Tangent Line in *w*.

Setting one foot of the Compasses on *w*, extend the other to the Pole P, with this extent you may strike the Arch *n* P ☉, which shall intersect the Ecliptick on both sides, with the Line of Longitude in ☉ and *n*, this shall be the *Proper Meridian* to the place of the Sun.

In like manner on the Center *q*, with the distance P *q*, you may strike the Arch H P *r*, which passing through the Pole shall intersect the Horizon of the Diske on both sides, where it cuts the Ecliptick; this shall cut the *Proper Meridian* at right Angles in the Pole, and is therefore the *Six a Clock Hour-circle* to that place of the Sun.

Conceive both the *Colures*, the *First*, and *Proper Meridian*, the *Hour-circle of Six*, together with the *Path of the Vertex*, and in General all the Lines hereafter to be described as a *Fixed Rete*, close investing the Earth whilst she turns round within them.

And now betwixt the *Proper Meridian*, the *Ecliptick*, and *Solstitial Colure*, we have formed the Spherical Triangle ♋ P ☉, right Angled at ♋, wherein we have given ☉ ♋, the Complement of ♈ ☉ the Suns distance from the Equinoctial 45° 00′; ♋ P, the Complement of P *e*, the distance of the Poles of the Globe and Ecliptick 66° 31′; with the Angle at ♋ *Right*, to find, 1. P ☉ *the Suns distance from the Pole*, 2. ♋ P ☉, the Complement of ☉ P ♈, *his right Ascension from* ♈, and 3. P ☉ ♋, *the Angle of the Meridian passing by the Sun with the Ecliptick*: For the first, or P ☉, by the demonstrated properties of Spherical Triangles, it will hold,

R . cs, ⊙♋ :: cs, ♋P . cs, P⊙, or,

		°	′	″	Log.
As the Radius,		90	00	00	10,000000
To the Sine of the two Poles Distance;	S.	23	29	00	9,600409
So the Sine of the ⊙*s Longitude from the Equinox*.		45	00	00	9,849485
To the Co-sine of his Distance from the next Pole:		73	38	03	x9,449894

Whose Complement P*i*, 16° 21′ 57″, is the Distance of the *North Pole* from the *Horizon of the Disk*, or the *Reflection* equal to the ⊙s *Declination* in the *Ptolemaick Systeme*.

The ⊙*s right Ascension* is that Angle at the Pole, which the proper Meridian ⊙P forms with the first ♈P, its Complement ⊙P♋ will be found in the aforementioned Triangle, by this proportion,

R . s, ♋P :: cs♋⊙ . ct⊙P♋, wherefore it will hold,

As the Radius,	S.	90	00	00	10,000000
To the Co-sine of the Distance of the two Poles;		23	29	00	9,962453
So the Tangent of the ⊙*s Longitude from the next Equinoctial Point*,		45	00	00	10,000000
To the Tangent of his right Ascension from the said Point:		42	31	35	x9,962453

If the Sun had appeared in the middle of ♒, where he is equally distant from the first Point of ♈, this Arch subtracted from 360, the right Ascension of the last Point of the Ecliptick, had given his right Ascension there 317° 28′ 25″.

If he had appeared as far remote from the opposite Equinoctial Point, either in the middle of ♌ or ♍, this Arch Subtracted from 180 Degrees, the right Ascension of the opposite Point, had given 137° 28′ 25″ his right Ascension in the middle of ♌, added to 180, it would make 222° 31′ 35″, the same in the middle of ♍.

After this manner by the right Ascensions calculated only to one Quadrant of the Ecliptick, the same may be made out to every Degree of the whole.

For finding the third of the General Requisites, or the Angle P⊙♋, which the proper Meridian makes with the Ecliptick, in the same Triangle we may say

S⊙R

s⊙P . R :: t, ♋P . t ♋⊙P or,

As the Co-sine of the ⊙*s Longitude from* ♈ *or* ♎,	45	00	00	9,849485
To a Radius;	90	00	00	10,000000
So the Co-tangent of the two Poles Distance,	23	29	00	10,362044
To the Tangent of the Angle of the Meridian and Ecliptick.	72	55	20	10,512559

SECTION V.

Before any other requisites can be investigated, the *Path of the Vertex* or place to which they are required must be described, which may be done according to the directions of the third Chapter; this for *London* will be in the third and fifth Figure the Circle *xfmg*, by whose intersections with the six a Clock Hour-circle *ka*, and the Points ⊙ *n* strike two Arches of Circles, then to find the two first particular requisites, or, Fig. 5.

The Suns distance from the Vertex at the hour of six,
The Suns Azimuth at the hour of six,

In the Spherical Triangles P⊙*k*, P⊙*a*, right Angled at P, are given P*k* = P*a*, the distance of the Pole from the Path, or the Complement of the Latitude 38° 30′; P⊙ the distance of the Sun from the Pole, found before 73° 38′ 03″; to find ⊙*k*, or ⊙*a*, the distance demanded, with P*k*⊙ or P*a*⊙, the Azimuth of the Sun from the North at the said hour; for the side ⊙*k* you may say,

R . csP⊙ :: csP*k* . cs⊙*k*, or,

As the Radius,	S.	90	00	00	10,000000
To the Co-sine of the Latitude;		51	30	00	9,794149
So the Sine of the Reflection,		16	21	57	9,449894
To the Co-sine of the Suns Distance from the Vertex.		79	53	52	x9,244043

And for the ⊙s Azimuth at six, or the Angle ⊙*k*P,

S, *k*P . R :: t, ⊙P . t, ⊙*k*P, or,

As the Co-sine of the Latitude,		51	30	00	9,794149
To the Radius;	S.	90	00	00	10,000000
So the Tangent of the ⊙*s Distance from the Pole*,		73	38	03	10,532143
To the Tan. of his Azimuth from the North Merid.		79	38	23	10,137994

C 2 For

For in what part of the *Path* soever the Vertex is found, that part of the Hour-Circle intercepted betwixt it and the Pole, is the *North part of the Meridian* in all North Latitudes; And therefore the Angle P k ⊙, formed betwixt it and the Line passing from the *Vertex* to the Sun, shall be his *Azimuth from the North Meridian.*

SECTION VI.

THerefore in what part of the Path soever it happens, that the *Meridian* shall be found to cut the Line passing from the *Vertex* to the Sun at right Angles, he appears due East, or West, or, as the *Ptolemaicks* would phrase it, on the Prime Vertical.

Fig. 4. Let now two Arches of Circles ⊙ *b n*, ⊙ *l n*, be strook so, as they may pass through the two intersections of the Line of Longitude, and the Ecliptick ⊙ *n*, and but just touch the Path on each side it; the Points of Contingence at *b* and *l*, shall be the places in the Path from whence Hour-Circles strook through the Pole, shall intersect the Circles passing by the Sun at right Angles, in which therefore he shall appear due East or West; and now we have formed another pair of Triangles, (see the 4 Figure) P *l* ⊙ P *b* ⊙, in which we have sufficient given to determin

The Sun's distance from the Vertex when due East or West, and,

The time from Noon when he shall be so:

For in the said Triangles are given the Hypothenusa ⊙ P, the Suns distance from the Pole of the Globe as before 73° 38′ 03″: the distance of the Pole from the Path P *b*, or P *l* 38° 30′ 00″: with the right Angles at *b* and *l*, to find ⊙ *b*, or ⊙ *l* the distance desired, or ⊙ P *b* = ⊙ P *l*, when he shall appear as required; for the first it will hold,

cs P *b* . R :: *cs* ⊙ P . *cs b* ⊙, or,

As the Sine of the Latitude,	51 30 00	9,893544
To a Radius;	90 00 00	10,0000000
So the Sine of the Reflection,	16 21 57	9,449894
To the Co-sine of the Suns Distance from the Vertex when due East or West.	68 53 50	9,556350

And for the latter,

t, ⊙P . *t*, P*b* :: R . *cs* ⊙ P *b*, or,

As the Tangent of the ⊙*s Distance from the Pole,*	73 38 03	10,532143
To the Co-Tangent of the Latitude;	51 30 00	9,900605
So is the Radius,	09 00 00	10,000000
To the Co-sine of the hour from Noon, when the Sun is due East or West.	76 29 28	9,368462
	h. ′ ″	
Which is =	05. 05 58	

SECT.

SECTION VII.

THE Motion of the Earths Rotation about its Axis, is as hath been said from West to East, and therefore the Sun is then said to *Rise*, when the Vertex passes that Point in the Path at *o*, where it cuts the Horizon of the Diske; to *Culminate*, when it crosses the Meridian betwixt him and the Pole at *d*; and to *Set* when it passes over the other intersection of the Path and Horizon at *g*: Let the Arches of a pair of Hour-Circles be strook through the said intersection of the Path and Horizon, as likewise two others, through ⊙ *n*, and the said two Points; so shall there be two Triangles formed on each side the Meridian; that is, ⊙ P *o*, *o* P *i*, on the Oriental or ascending side, ⊙ P *g*, *i* P *g* on the occidental, in either of which we may find sufficient given, for determining the Suns Azimuth, Rising or Setting, and the time he Rises or Sets from Noon: For in the larger Triangles ⊙ P *g*, ⊙ P *o*, are known, ⊙ P the Suns distance from the Pole, P *o* = P *g*, the distance of the Pole from the Vertex, with the sides ⊙ *o*, ⊙ *g* Quadrants; to find P *o* ⊙ or P *g* ⊙ the Suns Azimuth, in this case from the North Rising or Setting; and ⊙ P *o* or ⊙ P *g*, the time before or after Noon: But in this case because the Angles ⊙ P *o*, ⊙ P *g*, are obtuse, it may be more convenient to use the lesser Triangles, in which are given P *i*, the Reflection, P *o* = P *g*, as before, and the Angles at *i* right, to find P *g i*, or P *o i* (the Complements of ⊙ *g i* and ⊙ *o i*) the Suns Amplitudes Rising or Setting from the East or West: and *i* P *o* = *i* P *g*, the time of his Rising after, or Setting before Midnight; I shall make use of the oriental of these lesser Triangles, in which it will hold, *Fig.* 4.

S, P *g* . R :: *s*, P *i* . *s* P *g i*, or,

As the Co-sine of the Latitude,	51 30 00	9,794149
To the Radius;	S. 90 00 00	10,000000
So the Sine of the Reflection,	16 21 57	9,449894
To the Sine of the Amplitude.	26 54 45	9,655745

Whose Complement to a Quadrant 63° 05′ 15″ is the Suns Azimuth, in this case from the North, but when the Pole is in the obscure Hemisphere, from the South Meridian, in his Rising or Setting.

For the Ascensional Difference, say,

t, P *g* . R :: *t*, P *i* . *cs*, P *g i*, or,

As the Co-Tangent of the Latitude,	51 30 00	9,900605
To the Tangent of the Reflection;	26 21 57	9,467856
So the Radius,	S. 90 00 00	10,000000
To the Sine of the Ascensional Difference	20 15 49	9,567251

Whose

Whoſe Complement 69° 44′ 11″ converted into time, gives the Suns Riſing 4 *h.* 38′ 57″, and therefore that time of his Setting at 7 *h.* 21′ 03″ Afternoon.

Section VIII.

THE *Meridional Diſtance of the Sun from the Vertex*, may be found only by comparing the Suns diſtance from the *Pole of the Globe*, with the diſtance of the *Vertex* from the ſame *Pole*: For the leſſer of theſe Subtracted from the greater, will leave the *Suns Meridional Diſtance from the Vertex.*

But Note, that if the *Suns Diſtance from the Pole*, be leſs than the diſtance of the *Path* from it; whence the Vertex paſſes the Meridian, he will appear betwixt the Pole and it; that is, to the North of the Vertex in Northern, and to the South in Southern Latitudes.

But if the Suns diſtance from the Pole be bigger than the Paths diſtance from it, he croſſes the Meridian to the South of the Vertex, in Northern Latitudes, and to the North in Southern.

And if the Sum of the Suns, and Paths diſtance from the Pole be leſs than 90 Degrees, he ſhall appear twice upon the Meridian in 24 hours, once above, and again after 12 hours beneath the Pole, the Difference of them being his diſtance from the Vertex to the South in Northern, to the North in Southern Latitudes; but their Sum, his remoteſt diſtance from the Vertex to the South, in Southern Latitudes; and to the North in Northern which frequently happens in thoſe places, that lie betwixt the Arctick and Antarctick Circles, and their Poles.

Hence the Rules are eaſily made for finding the Latitude, the Suns diſtance from either of the Poles, and his Meridional diſtance from the Vertex being given: but this I ſuppoſe has been already ſhewn. If the Reader finds it otherways, or think me deficient in this Point, it may excuſe me, when I have informed him, that I could not be permitted the ſight of what has been already Printed, upon which account it is I forbear leaſt I ſhould only do what has been already done, and therefore needleſs.

Fig. 3. In my third Figure, if according to theſe Rules, from the Suns diſtance from the Vertex ⊙ P 73° 38′ 03″, you ſubtract the diſtance of the Path from the Pole 38° 30′ 00″, the reſidue 35° 08′ 03″, ſhall be ⊙ *d*, the Suns Meridional diſtance from the Vertex at that time.

SECT.

Section IX.

THE Suns diſtance from the Pole, together with the hour from Noon being given, to find his diſtance from the Vertex in any given Latitude. *Fig.* 3.

Let the hour propoſed be Four beford Noon, or Eight in the Morning, and the Suns diſtance from the Pole as before.

Having made P T the Radius of a Tangent Line, and therewith divided the Line *q* T *w* both ways from T, the Points *q* and *w* will be found to fall $42\frac{1}{2}$ Degrees of the ſame, on each ſide T.

The Center of the proper Meridian is at *w*, Count therefore 60 Degrees (= to 4 hours) in the divided Tangent Line from *w* towards *q*, the Center of the Six a Clock Hour-Circle, theſe ſhall terminate at *y*, and there is the Center of that Hour-Circle; which if ſetting one Foot of the Compaſſes on *y*, you ſtrike through P, it ſhall form an Angle of 60 Degrees with the Meridian, and the Point 8, where it interſects the Path, ſhall be that place, the Vertex ſhall paſs, at 8 a Clock in the Morning, or 4 hours before Noon.

Let the Arch of a Circle 8 ⊙, be ſtruck through this Point and the Suns place, ſo as it may alſo paſs through his oppoſite place *n*; then to find what is required, in the Oblique Angled Triangle P ⊙ 8, are given ⊙ P 8, the hour or Angle at the Pole 60° 00′ 00″, the diſtance of the Pole, and Path P 8, 38° 30′ 00″, with P ⊙ the diſtance of the Sun from the Pole 73° 38′ 03″, to find ⊙ 8 the required diſtance of the Vertex from the Sun: which will be gotten by the ſecond Caſe of Oblique Spherical Triangles, for,

As the Radius,	S. 90	00	00	10,000000
To the Co-ſine of the hour from Noon;	60	00	00	9,698070
So the Tangent of the Poles Diſtance from the Vertex,	38	30	00	9,900605
To the Tangent of firſt Segment.	21	41	19	9,599575

Which, becauſe the Angle ⊙ P 8 is acute, the hour propoſed being leſs than Six hours from Noon, ſubtracted from the Suns diſtance from the Pole 73° 38′ 03″, leaves the ſecond Baſe or Segment 51° 56′ 44″.

Again,

As the Co-ſine of the firſt Segment,	21	41	19	*Ar.C.* 0,031888
To the Co-ſine of the ſecond;	51	56	44	9,789870
So the Sine of the Latitude,	51	30	00	9,893544
To the Co-ſine of the ⊙s Diſtance from the Vertex.	58	43	26	9,715302

Note, that when the hour propoſed is more than Six from Noon, the Perpendicular falls without the Triangle, and then you muſt add the Suns diſtance from the Pole, to the firſt Segment, to get the ſecond.

SECT.

SECTION X.

THE converse of the preceding propositions is of more frequent use in *Astronomy*, and therefore I shall next shew how, The Latitude of the place, the Suns distance from the Pole, with his observed distance from the Vertex, being given, to find the Hour from Noon.

Fig. 3. In the aforementioned Triangle ⊙ P 8, let ⊙P represent the Suns distance from the Pole 73° 33' 03", P 8, the distance of the Pole from the Vertex, or Complement of the Latitude 38° 30' 00", and ⊙ 8 his distance from the Vertex before Noon, 58° 43' 26"; we have three sides of an Oblique Angled Spherical Triangle given, and the Angle at P required; which may be obtained by the 11 Case of such Oblique Angled Triangles: Wherefore add the three *data* together, and from half their Sum subtract the Suns distance from the Vertex, reserving the difference, then say,

As the Radius,
To the Sine of the Suns Distance from the Pole;
So is the Co-sine of the Latitude,
To a fourth Sine.

And Again,

As the fourth Sine,
To the Sine of half the Sum of the given sides;
So is the Sine of the Difference reserved,
To a seventh Sine.

To which if you add the Radius, half that Sum will be the Co-sine of half the hour from Noon. I proposed

The Suns Distance from the Pole P ⊙	73	38	03
The Complement of the Latitude P 8	38	30	00
The Suns Distance from the Vertex ⊙ 8	58	43	26
Sum	170	51	29
½ Sum	85	25	44½
Subtract ⊙ 8	58	43	26
Difference	26	42	18½

R = S,	90 00 00	10,000000
⊙P S,	73 38 03	9,982037
P 8 S,	38 30 00	9,794149
S,	4th. Arch	9,776186

Fourth

Fourth Arch *Ar. Co.*		0,223814
S, ½ Sum	85 25 44½	9,998616
S, Diff.	26 42 18½	9,652632
7 Sine + R		19,875062
½ cs	30 00 00	9,937531

Doubled 60 00 00 = 4 hours, the time from Noon, or Eight in the Morning, at which the Suns distance from the Vertex, was found 58° 43' 26", in the work of the last proceeding Case.

SECTION XI.

THE Suns distance from the Pole, his distance from the Vertex, and the Latitude being given, if his Azimuth shall be required: The case is the same with the preceding, for in the same Triangle ⊙ P 8; are given the three sides P ⊙, P 8, 8 ⊙, as before, only whereas we then enquired the Angle at the Pole P, we must now seek the Angle at the Vertex 8, for that is the Suns Azimuth from the North part of the Meridian.

Add therefore as before the Suns distance from the Pole, his distance from the Vertex, and the Complement of the Latitude together, and from half that Sum subtract the Suns distance from the Pole, then say:

As the Radius,
To the sine of the Suns Distance from the Vertex;
So the Co-sine of the Latitude,
To a fourth sine.

And Again,

As that fourth sine,
To the sine of the half Sum;
So the sine of the Difference,
To a seventh sine.

To which if you add the Radius, half that Sum will be the Co-sine of half the Suns Azimuth from the North.

Let now the *data* be the same as in the last case, and the Suns Azimuth or the Angle at 8, enquired.

 The

The Complement of the Latitude P 8 *is*			38 30 00
The Suns Distance from the Vertex ⊙ 8			58 43 26
From the Pole P ⊙			73 38 03
Sum			170 51 29
½ Sum			85 25 44½
The Suns distance from the Pole			73 38 03
Subtracted leaves the Difference			11 47 41½
Rad. S,	90 00 00		10,000000
8 ⊙, S,	58 43 26		9,9[illegible]1801
P 8, S,	38 30 00		9,794149
Fourth sine			9,725950
Fourth sine		*Ar. Comp.*	0,274050
½ Sum S,	85 25 44½		9,998616
Diff. S,	11 47 41½		9,310498
Z + R			19,583164
½ = cs	51 46 05		9,791582

Doubled 103 32 10 the Suns Azimuth from the North Meridian, or the Angle at 8 required, its Complement to a Semicircle 76° 27′ 50″, his Azimuth from the South.

Section XII.

If the end of the Twilight in the Evening, or the first dawn of the Day in the Morning, were required, it must be considered; that the Daylight reaches to the Horizon, when the Sun is 16 Degrees beneath it; or as the *Copernicans* had rather express it, the Vertex sees the light of the Sun untill it be 16 Degrees distant from the Horizon of the Diske, in the obscure Hemisphere of the Earth. Count therefore
Fig. 5. 16 Degrees in the Periphery of the Ecliptick, from each of its intersections with the Horizon of the Diske, into the obscure Hemisphere; or from H to γ, and from r to e, then laying a Ruler over γ r, mark the Point *m* where it intersects the Line of the Suns Longitude.

The Tangent of 74 Degrees (the Complement of 16) to the Radius e ♈, shall be the Semidiameter of a Circle, that shall pass through these three Points; of which if you strike the Arch γ m e it shall be the *Parallel of* and *Twilight*, the Point ζ, wherein it intersects the occidental part of the Path, shall be that place the Vertex transits, when the Twilight ends in the Evening.

Strike

Strike the Arch of a Circle through this Point ζ, so as it may also pass through the Sun, and his opposite place at n; through the said Point and the Pole P, strike also the Arch of an Hour-Circle ζ P, so have you formed the oblique Angled Triangle P ζ ⊙, in which are given P ζ the Complement of the Latitude 38° 30′, P ⊙ the Suns distance from the Pole 73° 38′ 03″, and ⊙ ζ, the Suns distance from the Parallel, to find the Angle at P, or the hour from Noon, when the Twilight ends, which may be obtained by the 11 case of Spherical oblique Angled Triangles, thus,

Add together the Suns distance from the Pole, his distance from the Parallel, and the Complement of the Latitude; from the half of the Sum subtract the Suns distance from the Parallel, reserving the difference. Then say,

As the Radius,
To the Co-sine of the Latitude;
So is the sine of the Suns Distance from the Pole,
To a fourth sine.

And Again,

As that fourth sine,
To the sine of half the Sum of the sides;
So is the sine of the Difference, reserved,
To a seventh sine.

To which add the Radius; half the Sum shall be the Co-sine of half the hour from Noon.

For Example.

When the Suns Distance from the Pole is		73 38 03
Complement of the Latitude		38 30 00
The Parallel from the Sun		106 00 00
Sum		218 08 03
½ Sum		109 04 01½
⊙ ζ Sub.		106 00 00
Difference		3 04 01½
S,	90 00 00	10,000000
P ζ S,	38 30 00	9,794149
P ⊙ S,	73 38 02	9,982037
S,	4th. Arch	9,776186

D 2 Fourth

Fourth Arch,	*Ar. Comp.*	0,223814
½ Sum S,	109 04 01½	9,975495
Difference 8,	3 04 01½	8,728396
Z + Radius,		18,927705
½ *cs*,	73 05 02	9,463852

Doubled makes 146 10 04 equal to 9 h. 44′ 40″, at which time the Twilight ends, and it becomes perfectly dark. Subtract theſe from 12 hours, the remainer 2 h. 15′ 20″, is the time of the firſt Day-break in the Morning, the Sun being in the ſame place in the Ecliptick; Note that where the Path cuts not the Parallel of Twilight, tis no perfect darkneſs at Midnight, but Twilight only lighter, or darker, as the Path approaches nearer the Parallel.

SECTION XIII.

IN the Calculation of Solar Eclipſes, and the Moon's Tranſits over fixed Stars, it is uſually required to know what Point of the Ecliptick Culminates in the Meridian, what is the higheſt Point of it, and the *neareſt Diſtance* of each of theſe from the *Vertex*, and what is the Angle which the Vertical Circle makes with the Ecliptick, in any Point of it, at any given time. Theſe are difficultly ſhewn in the *Ptolemaick* Projections, readily and eaſily in ours; thereby proving *that the moſt ingenious of human inventions, are far leſs facile then the ordinary performances of Truth and Nature:* I ſhall therefore next ſhew how each of theſe may be repreſented in the true Syſtem of the World, and calculated.

Let the Suns place be as before propoſed, and the forementioned requiſites demanded to 2 h. Afternoon.

The Center of the proper Meridian is at *w*, Count 30 Degrees anſwering to 2 hours in the Tangent Line divided as before directed, from *w* to the right hand, an Hour-Circle ſtruck with one Point of the Compaſſes ſet on the Point ſo found in the Tangent Line, through the Pole P, ſhall cut the Path in the Point θ, which the Vertex ſhall traverſe at 2 hours after Noon, the Ecliptick upon the Point C on the Meridian, and a Line produced through the Pole, *e* and the interſection of the Path, and this Arch at θ, ſhall interſect the Ecliptick in the Nonageſime degree, or Point neareſt the Vertex at N, C N being the diſtance of the Nonageſime degree from the Meridian, N its diſtance from the Vertex, and C θ the diſtance of the Point on the Meridian from the Vertex.

To

To define theſe by Calculation.

In the Triangle C ♋ P are given, ♋ P, the Complement of ♈ P ♋, the right Aſcenſion of the Midheaven or Point of the Ecliptick in the Meridian 17° 28′ 25″, P ♋ as before 66° 31′, and the right Angle at ♋, to find ♋ C the Complement of ♈ C, the Longitude of the Midheaven from the firſt Point of the Ecliptick, and P C, the diſtance of the Midheaven from the Vertex, we may ſay, therefore,

R . *t*, ♋ PC :: *s*, P ♋ . *t* PC, that is,

As the Radius,	*S.* 90 00 00	10,000000
To the Co-tangent of the right Aſcenſion of the Midheaven;	72 31 35	9,498024
So the ſine of the Diſtance of the Pole and Tropick,	66 31 00	9,962453
To the Co-tangent of the Longitude of the Mid heaven from the next Equinoctial Point.	73 53 45	9,460477

Therefore the Midheaven is ♊ 13° 53′ 45″; for P C it will hold,

R . *cs*, ♋ PC :: *t*, ♋ P . *t* CP, or,

As the Radius,	*S.* 90 00 00	10,000000
To the Tangent of the Diſtance of the two Poles;	23 29 00	9,637956
So the ſine of the right Aſcenſion of the Midheaven,	72 31 35	9,979483
To the Co-tangent of its Diſtance from the next Pole.	67 29 24	9,617439

From which if according to the directions of the Eighth Section, we take away P θ 38° 30′, the diſtance of the Pole from the Vertex, the remainer θ C ſhall be the diſtance of the Midheaven from the Vertex, 28° 59′ 24″.

To find N ♋, the Complement of ♈ N, the Longitude of the Nonageſime, with N θ its diſtance from the Vertex; in the Oblique Angled Triangle, P *e* θ, are given P *e* the diſtance of the two Poles 23° 29′, P θ the Complement of the Latitude, or Semidiameter of the Path 38° 30′, with the included Angle *e* P θ, the difference of the right Aſcenſions of the Midheaven, and firſt Point of ♑ 162° 31′ 35″, to find the Angle P *e* θ = ♋ N, the Longitude of the Nonageſime from the firſt Point of ♋, with θ N, its diſtance from the Vertex, which may be obtained by the Second and Tenth Caſes of Oblique Angled Spherical Triangles, for,

As

As the Radius,	90 00 00	10,000000
To the Co-tangent of the Latitude;	51 30 00	9,900605
So the sine of the right Ascension of the Midheaven counted from ♈ or ♎,	72 31 35	9,979483
To the Tangent of the first Segment.	37 11 20	9,880088

If the Angle *e* P θ be obtuse, as in this Case, the Sum of the first Segment and the distance of the two Poles; but if it be acute, their difference, shall be the second Segment.

In this Case therefore the second Segment will be 60° 40′ 20″.

Say Again,

As the sine of the second Segment,	60 40 20 *Ar.C.*	0,059567
To the sine of the first;	37 11 20	9,781356
So the Co-sine of the right Ascension of the Midheaven from ♈ or ♎,	62 31 35	9,498024
To the Co-sine of its Longitude.	77 41 18	9,338947

Therefore the Nonagesime ♊ 17° 41′ 18″, for its distance from the Vertex, say,

As the Co-sine of the first Segment,	37 11 20 *Ar.C.*	0,098734
To the Co-sine of the second Segment;	60 40 20	9,893544
So the Co-sine of the Latitude,	51 30 00	9,[illegible]0023
To the sine of its Vertical Distance.	28 45 43 θ N	[illegible]682301

Whose Complement 61° 14′ 17″, *is its Distance from the Horizon.*

If it be demanded, what Angle the Circle passing from the Vertex to the Sun, makes with the Ecliptick at his Center, strike a Circle through the Sun, his opposite place *n*, and the Vertex; So shall you form the Triangle θ N ⊙, in which are given N ⊙, the Suns distance from the Nonagesime 32° 41′ 18″, N θ the distance of the Nonagesime from the Vertex, and the Angle at N right, to find the Parallactick, or required Angle, you may say therefore,

S, N ⊙ . R :: *t*, N θ . *t* N ⊙ θ, [illegible]r,

As the sine of the ⊙s Distance from the Nonagesime,	[illegible] 18	9,732449
To the Radius;	[illegible] 00	10,000000
So the Tangent of the Distance from the Vertex	28 45 43	9,739485
To the Tangent of the Parallactick A[illegible]	45 27 31	10,007036

But

But if the Parallactick Angle at the Moon, or some Star that has Latitude from the Ecliptick, be demanded; it will require some farther labour to investigate it. Let the time proposed, and consequently the Nonagesime Degree, and the distance of the Vertex from the Pole be as before found, and let the Parallactick Angle at *Pollux*, whose Longitude is ♋ 18° 47′ 30″, distance from the Pole of the Ecliptick 83° 21′ 30″, be demanded: Let ✳ represent the place of *Pollux*, the Arch N V equal to the Angle θ *e* ✳, the difference of the Longitude of *Pollux* and the Nonagesime, shall be 31° 06′ 12″: Strike the Arch of a great Circle ✳ θ from the Vertex to *Pollux*, so have you formed the Oblique Angled Spherical Triangle, ✳ P θ, in which are known *e* θ, the distance of the Vertex from the Pole of the Ecliptick 61° 14′ 17″, with *e* ✳ the distance of *Pollux* from the Pole of the Ecliptick 83° 21′ 30″, and the Angle θ *e* ✳ as before; to find the Angle *e* ✳ θ, the Complement of the Parallactick Angle, with θ ✳ the distance of the Star from the Vertex, which will be got by the second and tenth Cases of Oblique Angled Spherical Triangles, by which it will hold:

As the Radius,	90 00 00	10,000000
To the Co-sine of the ✳s Distance from the Nonagesime;	31 06 12	9,932594
So the Tangent of the Distance of the Vertex from from the Pole of the Ecliptick,	61 14 17	10,260515
To the Tangent of the first Segment.	57 20 17	10,193109

The difference betwixt the first Segment, and the Stars distance from the Pole of the Ecliptick, shall be the second Segment in this Case 26° 01′ 13″.

Say Again,

As the sine of the second Segment,	26 01 13 *Ar.C.*	0,357843
To the sine of the first;	57 20 17	9,925245
So is the Tangent of the ✳s Distance from the Nonagesime Degree,	31 06 12	9,780546
To the Co-tangent of the Parallactick Angle.	40 49 02	10,063634

And for the Stars distance from the Vertex,

As the Co-sine of the first Segment,	57 20 17 *Ar.C.*	0,267863
To the Co-sine of the second Segment;	26 01 13	9,953585
So the Co sine of the Distance of the Vertex from the Pole of the Ecliptick,	61 14 17	9,682316
To the Co sine of the ✳s Distance from the Vertex.	36 45 04	9,903764

SECT.

SECTION XIV.

HOwever large the Diameter of the Earths Annual Orb may appear to be, collated with her own Diameter, yet if it be compared with the vast distance at which the fixed Stars are placed, the Angle it subtends becomes almost insensible. So that in what part soever of her Orbit the Earth is found, she is yet conceived by *Copernicans* as in the Center of the Starry Sphere; and then lines produced from her Center to each Star shall design their places in that Rete, which we before imagined to invest its superficies; and their Longitudes and right Ascensions, will be determined by their respect to the Equinoctial Point, and Colure; their Latitudes by their distances from the Ecliptick; and their Declinations, by the like distances from the Circle bisecting the Globe, equally distant from both its Poles, called the *Equator*.

The distances and positions of the fixed Stars one from another, have been found the same in all Ages; so that it is probable they are subject to no Motion, but what appears in them by reason of the continual recess of the Earths Equinoctial Points; the manner and reason whereof, will be conceived by the first Figure; In which view the Earth at ♎, its Motion round its Axis is from West to East, or from *d* by *i* to *t* in the illuminate part of the Globe, or that next the Sun. But the Motion of the Ætherial Matter is also from West to East, or from *a* to *b* directly contrary to this in the same illuminate part of the Globe, and that too something stronger than in the remoter or obscure part; by reason the parts near the Sun are swiftlier moved than the more remote; thence it proceeds that the *Line of Direction*, or Plane connecting the Poles *t* P *e d*, is reflected and born back contrary to the Earths, and *Vortex* Motion, 50 Seconds Annually. So that whereas about the beginning of *Nabonassar's Æra*, it cut the Ecliptick, and consequently made the Solstice, near the Cloudy place in ♋, it is now carried back to the Heel of of *Castor*, and about 250 years hence, it will make the Solstice when the Earth passes under *Propus*.

Fig. 1.

That Point of the Orbit, where when the Earth arrives, the Line of direction, or Solstitial Colure, coincedes with the Horizon of the Diske, and the North Pole, passing out of the obscure, begins to enter the illuminate part of the Globe, is the place where the vernal Equinox is made, and the Sun enters the first Point of ♈. This Point about the time of *Nabonassar*, was at N, but since by the continual impression of the Ætherial matter, and its renitency to the Earths Motion, tis reflected equally with the Solstitial Colure, which is altered from *n e a* to *t e d* receding continually, so that if the Earth continue some Ages longer, the Equinoctials may happen under those Stars, near which the Solstices were celebrated at the Creation.

Hence

Hence it is that the places of the Equinoxes receding from the fixed Stars, they seem to move slowly, but equally forward from the Equinoxes, about one Degree in 72 years, those which appeared near the Equinoctial Points, or some few Degrees in Antecedence, as *Spica* ♍s did in the time of *Hipparchus*, being now found near 20 Degrees in consequence of them.

But though the Longitudes of the Stars alter yearly, yet may their places once determined to a known year, be made out to any other, past or to come, by the sole Subtraction or Addition of so many times 50 Seconds from or to the given Longitude, as there are years betwixt that to which the place of the Star given is rectified, and at which it is demanded. Their Latitudes vary not, but their right Ascensions and Declinations depending on these, are continually changing, and that not regularly, but unequally, more or less according to the distances of each Star from the Pole of the Ecliptick, and the Colures. It will be therefore requisit to shew how from the given Longitude and Latitude of a Star, its right Ascension and Declination may be Calculated.

Let the Star proposed be *Pollux*, whose place to this year 1680. is stated ♋ 18° 47′ ½, and let its place, right Ascension, and Declination, be required to the year 1800. or 120 years hence.

To its given place 1680,	♋	18 47 30
Add the Motion for 120 *years future*;		1 40 00
It makes the Stars place to the year 1800, *in*	♋	20 27 30
Its constant Distance from the Pole of the Ecliptick being.		83 21 30

Let ✱ represent the place of *Pollux* on the Globe, *e* ✱ his distance from the Pole of the Ecliptick 83° 21′ 30″; and P *e* ✱ his Longitude from the Solstitial Colures 20° 27′ 30″, P *e*, the distance of the two Poles 23° 29′; we have here two sides of an Oblique Angled Spherical Triangle given, with the Angle betwixt them, to find the third side, and the Angle at P, which will be got by the Second and Tenth Cases of such Triangles, by these proportions.

As the Radius,	S. 90 00 00	10,000000
To the Tangent of the Stars Distance from the Pole of the Ecliptick;	83 21 30	10,933894
So the Co-sine of its Longitude from the Solstitial Colure,	20 27 30	9,971705
To the Tangent of the first Segment.	82 54 56	10,905599

When the Stars place is in the first six Signs of the Ecliptick, as in this Case, the difference betwixt the first Segment, and the distance betwixt the two Poles, shall be the second Segment; otherways their Sum shall make it.

The

The second Segment therefore in Pollux, 59° 25′ 56″.

Say Again,

As the sine of the second Segment,	59 25 56	*Ar.C.*0,064983
To the sine of the first Segment;	82 54 56	9,996672
So the Tangent of the Stars Longitude from the next Solstitial Colure,	20 27 30	9,571774
To the Tangent of its right Ascension from the same Colure.	23 15 57	9,633429

The right Ascension of the Colure is 90°; therefore of *Pollux* to the year 1800. will be 113° 15′ 57″. For its distance from the Pole of the Globe, say,

As the Co-sine of the first Segment,	82 54 56	*Ar.C.*0,908924
To the Co-sine of the second Segment;	59 25 56	9,706339
So the Co-sine of the Stars Distance from the Pole of the Ecliptick,	83 21 30	9,063181
To the sine of its Declination.	28 29 04	9,678444

Whose Complement 61° 30′ 56″, *is its Distance from the North Pole of the Globe.*

If the Angle P ✳ *e*, or the visible inclination of the Axis of the Globe to the Axis of the Ecliptick be demanded, it will hold,

As the sine of the Stars Distance from the Pole of the Ecliptick,	83 21 30	*Ar.C.*0,002925
To the sine of its right Ascension from the Colure;	23 15 57	9,596595
So the sine of the Distance of the Poles,	23 29 00	9,600409
To the sine of the Inclination.	09 07 04	9,199929

I might here proceed to shew how several other requisites in the *Sphere* would be formed and represented in this Projection, but it will be convenient to leave something imperfect, to exercise the Ingenuity of the Student; who if he throughly understand the preceding discourse, will readily find places wherein any other Problem will be determined. I shall therefore close this part, and in the following I shall shew how by a like, but Orthographical Projection of the Globe, the Moons Appulses to the Sun or Stars may be constructed, and all the Appearances of an Eclipse, Occultation or Transit represented to the Eye for several Latitudes in one Figure; which will be of great use to the Ingenious *Astronomer*, *Traveller*, and *Seaman*, and was never to be expected from any Hypothesis, that did not admit the Motion of the Earth.

THE

If both these shall be of the same Denomination, that is both to be added or both to be subtracted, their Sum, but if otherways, their Difference shall be the *Absolute Equation of Time*, which according to the Quality of the greater part ought to have been added or subtracted from the apparent time, if given, that so the Calculation might have been fitted to the Mean, as the Numbers require.

But since the Equation of Days could not be found without the Mean Anomalie and Suns place, these being attained we must seek a Correction. Enter therefore the Seventeenth Table with the Mean Anomalie, and against it in the Column entituled the *Earths true horary Motion*, take out the true hourly Motion of the Earth, then say,

As one hour or 60 Minutes, *to* the hourly Motion: *So* the *absolute Equation of time*, *to* the *Proportional Correction*.

Which if the Absolute Equation of Days were Additional, added to, otherways subtracted from the Suns place first found, gives his *true place* to the time proposed.

The following Example will explain these precepts; Let it be required to find the Suns true place in the year 1668; *October* the 25th. at 1 h. 5′ 30″, apparent time under the Meridian of *London*.

The year proposed is Leap-year, therefore I take the Mean Motion belonging to the 26th. of *October*, for the 25th. and the Calculation stands as follows.

	Mean Motion.				*Perihelion.*				
	s	°	′	″	s	°	′	″	
1661	09	20	25	46	03	06	35	00	
7	11	29	18	48			5	50	
October 25th. Bissex.	09	24	42	30				41	
1 Hour			2	28	03	06	41	31	Perihelion
5 Minutes				12	07	14	29	45	Mean Motion
30 Seconds				1	04	07	48	14	Mean Anomaly
Mean Motion	07	14	29	45	With the Earths Mean Ano. sub.		6′	8″	
Equation subtracted		1	32	01	Suns place		9	51	
Suns place	07	12	57	44	Absolute Equation of Days sub.		15	59	
Parts proport. sub.				40	Suns horary Motion		2	31	
Suns correct place	♏	12	57	04	Parts proportional subtract			40	

To Calculate the Moons true place at all times.

1. To the given time get the Suns true place and Equation of Days, according to the preceding directions, this added to, or subtracted from the apparent time, gives the true mean time.

2. In the Seventh Table seek the given year, if you find it not, write down the next less therein, with the Residue of years to the given, the Month, and day together, with the hour, Minute, and Seconds; and the several Mean Motions, and places of the Apoge and Node against them, as in the following Example.

3. Collect the Sum of the Moons Mean Motions, as also of her Apoge severally, but for her Node, draw a Line under the Radical place to the year first found, and adding the Motions under it into one Sum, subtract that from the Radical place, so have you the Mean Motions of the Moon, her Apoge, and Node.

4. With the Suns Mean Anomalie enter the Tenth Table, Entituled *A Table of Physical Parts*; and thence take out the Physical parts, standing against it, these according to their Title added to or subtracted from the Moons Mean Motion, give her *Mean Motion correct*.

5. From the Suns true place subtract the Mean Motion of the Apoge, the Residue I call the *Annual Argument*; with which entring the Eleventh Table take thence the Equation of the Apoge; this according to its Title added to or subtracted from the *Mean* place of the Apoge gives the true: In the same Table also with the Annual Argument take out the Excentricitie, which if it be less than the Mean (55237) subtract from it, if bigger take the Mean out of it, and note the difference.

6. From the Mean Motion of the Moon *correct*, subtract the true place of the Apoge, the remainer is the *Mean Anomalie*; with which entring the Twelfth Table Entituled, *A Table of the Equations of the Moons Center*, take the *Equation* answering to it under the *middle Excentricitie*, as also, if the true Excentricitie were more than the Mean, under the greatest, if less, under the least; Note their difference, then say, As 11617½, *to this difference: So the difference of the middle and true Excentricities, to the part proportional.* This if the true Excentricitie were greater than the middle, added to the Equation found under it, otherways subtracted from it, leaves the *true Equation of the Orbit*, which according to its Title, added to, or subtracted from the Moons correct mean Motion, gives her *Equated place.*

7. From the Moons *Equated place*, subtract the Suns; and with the difference in the Thirteenth Table, find the *Variation*, this according to its Title added to, or subtracted from the Moon's Equated place, leaves her *true place in her Orbit.*

8. From the Suns true place subtract the Mean Motion of the Node, the remainer *is the distance of the Sun from the Node*, with which entring the Fourteenth Table take out the *Equation of the Node*, this according to its Title added to, or subtracted from its Mean Motion, makes *its true place.* In the same Table also find the *inclination of the Limit above 5 degrees*, or the greatest Latitude of the Moons Orbit at that time.

9. From the Moons true place in her Orbit, subtract the true place of the Node, what remains is the *Argument of Latitude*, with which entring the Sixteenth Table find *the Reduction* with the *Excess*; then say, *As* 18′, *to the Excess; So the inclination of the Limit, or Excess of the Moons greatest Latitude above 5 Degrees, to the part proportional*; which added to the simple *Reduction* makes the true, and this according to its Title added to, or subtracted from the Moons true place in her Orbit, gives her *true place in the Ecliptick.*

10. For her true Latitude, enter the Fifteenth Table with the Argument of Latitude, and therein find the Moons simple Latitude, with the Excess or Increment, when the Inclination of her Orbit is 5° 18′; then say, *As* 18′ *is to the Increment; So the Excess or Inclination of the Orbit above 5 Degrees, to the part Proportional*; which added to her *simple Latitude*, makes the *true.*

Or having the Argument of Latitude, and the Inclination of the Moons Orbit; the *Reduction* and her present *Latitude* may be found perhaps more easily by these proportions.

As the Radius,
To the Co-sine of the Inclination of her Orbit;
So the Tangent of the Argument of Latitude,
To the Tangent of her Longitude from the Node in the Ecliptick.

Whose difference from the Argument of Latitude shall be the Reduction, which if the Argument of Latitude were in the first or third Quadrants, subtracted, otherways added to the Moons place in her Orbit, makes her place in the Ecliptick. For her Latitude,

As the Radius,
To the sine of the true Inclination of her Orbit;
So the sine of the Argument of Latitude,
To the sine of her true Latitude.

To find the Moons Horizontal Parallax, and Semidiameter at all times; with her true horary Motion at the Conjunction with or Opposition to the Sun.

In the Seventeenth Table you have given the Moons true horary Motions in Eclipses, with her Horizontal Parallaxes, and Semidiameters, under the least and greatest Excentricities, to every 6 Degrees of Mean Anomaly, noted in the outside Columns of the Table, by the sixth precept foregoing you may find the Excentricitie, from which subtract the least, and note their difference.

Then if the Moons true horary Motion were demanded, enter the said Table with the Mean Anomaly, and in the Columns of horary Motions take out the horary Motions answering to it under each Excentricitie; note their difference, then say, *As* 23235, (the difference of the least and greatest Excentricities) *to the difference of the horary Motions found; So the difference noted betwixt the present and least Excentricitie to the part proportional*; which if the horary Motion under the least Excentricitie, were less than that found under the greater, added to the Motion under the least, otherways subtracted from it, makes the hourly Motion of the Moon from the Sun, at the time of the Conjunction or opposition. After the same manner would the Horizontal Parallax, and Semidiameter be obtained, if demanded, and therefore I need not give any farther directions for finding them.

To

To explain these precepts by an Example, let it be proposed to find the Moons true place and Latitude, her Horizontal Parallax and Semidiameter, in the present year 1680. on the 22th. of *December*, at 6 h. 30′ time apparent Afternoon under the Meridian of *London*.

The Suns Mean Anomalie will then be 6 *s.* 5° 7′½; his true correct place ♑ 12° 09′ 35″; therefore the Equation of time 4′ 57″ to be added to the apparent, which makes the true Mean time 6 h. 34′ 57″ *p m*; to which according to the preceding Directions I collect the Mean Motions, and Equations, as follows,

	Mean Motion. s ° ′ ″	*Apoge.* s ° ′ ″	*Node Retrog* s ° ′ ″	
1661	01 18 10 14	5 00 21 51	6 21 04 47	Radical place of the Node.
19	11 21 00 07	1 23 03 29	0 07 27 20	
December 22B	23 58 22	1 09 46 22	18 54 19	
h. 6	3 17 39	1 40	48	
′ 34	18 40	10	5	
″ 57	31	8 03 13 32	0 26 22 32	Motion of the ☊ from the Radix.
Mean Motion	02 06 45 33	9 12 09 35	5 24 42 15	☊ true place.
Physical parts sub.	1 03	1 08 56 03	Annual Argu	ment.
		10 50 32	Equat. of the	Apoge add.
Mean Motion Cor.	02 06 44 30			
Apoge	08 14 04 04	8 14 04 04	True place	of the Apoge.
Meat Anomaly	05 22 40 26	Ex. 57678	Eq. under the	Greatest Excen. 01 03 52 } Diff. 12′ 1″.
Equation subtract.	54 22	M.Ex. 55237		Mean Excenter 00 51 51
☽ Equation place	02 05 50 08	Diff. 2441		Part propo. add 00 02 31
Suns	9 12 09 35			Absolute Equat. 00 54 22
☽ from the Sun	04 23 40 33	☊ Mean pla.	5 24 42 15	R.c.s. 5 01 36 9,998327
Variation subtract	36 16	Suns	9 12 09 35	t. 71 29 22 10,475214
☽ in her Orb	02 05 13 52	☽ from the ☊	3 17 27 20	t. 71 25 22 10,473541
Node	05 23 44 30	Equat. ☊ sub.	57 45	Red. sub. 4 00
Argument of Lat.	08 11 29 22	☊ true place	5 23 44 30	R.s. 5 01 36 8,942600
Reduction Subtra.	4 00	In. of the Orb	5 01 36	s. 71 29 22 9,976930
☽ place in the Eclip	♊ 05 09 52			s. 4 45 58 8,919530
Latitude South	04 45 58	Hence the M. true place is ♊ 5 09 52		
Moons Horiz. Paral	61 31	Latitude South 4 45 58		
Horizontal Semid.	16 4			

The place of the Bulls South Eye is at this time ♊ 5° 19′, its Latitude South 5° 30′: So that the Moon may cover it in several places of the Earth; how the application to it will appear in our or any other Horizon I shall shew hereafter; at present it will be necessary to direct you how to find the time of the true Conjunctions or Oppositions of the Luminaries, and to Construct their Eclipses; after which, the Construction of Appulses will be easie.

SECT.

SECTION IV.

To find the time of the Mean Conjunction or Opposition of the Sun and Moon.

1. TO the Year and Month in which the *Mean Conjunction or Opposition* of the Luminaries is required, in the Twentieth Table, Entituled, *A Table of the Mean Motions of the Moon from the Sun*, Collect the middle Motions of the Moon from the Sun; take the Complement of this to 12 Signes, and from it or the Opposition (which if required, may be made by the Addition of 6 Signes to it) continually subtracting the nearest lesser Mean Motions, the answerable Days, Hours, Minutes, and Seconds; will shew the time of the *Mean Conjunction* or *Opposition* of the Sun and Moon.

For Example.

I desire to know the time of the *Mean Conjunction or New Moon* which will happen in *July* 1684.

	Moon from the Sun. s	°	′	″
1681	08	11	09	13
3	00	28	52	07
July	01	16	31	32
Motion of the ☽ from the Sun	10	26	32	52
Complement	01	03	27	08
Days 2	00	24	22	53
	00	09	04	15
Hours 17	00	08	38	06
	00	00	26	09
Minutes 51	00	00	25	54
Seconds 29	00	00	00	15

Therefore the Mean time of *the Mean Conjunction of the* Luminaries in *July* 1684. will happen *July* the first at 17 h. 51′ 29″ Afternoon, for the given year is *Leap-year.*

To

To find the time of the true Conjunction or Opposition of the Sun or Moon.

1. To the time of the *Mean Conjunction* or *Opposition* Calculate the true Longitude of the Sun from the Vernal Equinox, and of the Moon in her Orbit by the Directions of the last foregoing Section: If these be found exactly the same, or Opposite, the times of the *Mean and true Conjunction and Opposition are the same*, but if, as commonly it happens, they differ, then,

2. Note the difference, and with the Mean Anomalies of the Sun and Moon, (the Moons being first Corrected by the Addition or Subtraction of about half so much as she wants of, or is past the ☌ or ☍) enter the Seventeenth Table, Entituled, *A Table of the Moons true horary Motions*, &c. and in the second Column take out the Earths, by the third and fourth, get the Moons true hourly Motions, subtract the Earths from the Moons,

Then say,

As the Difference of the true hourly Motions,
Is to one Hour, or 60 Minutes of time;
So is the Moons Distance from the ☌ or ☍ of the Sun,
To the Interval of time betwixt the Mean and true ☌ or ☍, which is always less than 14 Hours.

If the Moon were found to want of the *Conjunction or Opposition* of the Sun, the *Interval* added, but if she was past either of them, subtracted from the time of the Mean ☌ or ☍, makes *the Mean or equal time of the true*; to which time again for greater certainty, compute the true places of the Sun, and ☽ in her Orbit, with the Moons Latitude, and the exact Mean time of the true ☌ or ☍, being found.

3. With the Suns Mean Anomalie, and true place, enter the first and second Tables, and thence take the *Equation of Natural days* according to the precepts of the last Section; this, if it were to have been added to the Apparent time, subtracted here; but if to have been subtracted, added to the Mean time of the true ☌ or ☍, makes the Apparent time of either in the Moons Orbit.

4. Enter the Nineteenth Table with the Moons true hourly Motion from the Earth, in the head, and the Argument of Latitude in the side, against them in the common Area you have the time of Reduction, which according to its Title added to, or subtracted from the Apparent time of the ☌ or ☍ in the Orbit, leaves the Apparent time of the *nearest approach of the Moons Center, to the Center of the Disk in Solar shadow in Lunar Eclipses.*

But if the same contrary to its Title be added to, or subtracted from the Apparent time of the true ☌ or ☍ in the Orbit, it makes the Apparent time of the true Conjunction or Opposition in the Ecliptick.

Example.

Example.

		h	′	″
1684.	The Mean Conjunction of the Sun and Moon *July* the first	17	51	29

s	°	′	″	
The Earths Mean Anomalie then . .	00	14	03	37
The Annual Argument	02	23	51	16
The Moons Mean Anomalie	02	20	14	44
The Suns true place	♋	20	30	50
The Moons in her Orbit	♋	16	00	46
The Moon short of the Conjunction .	00	04	30	04

The ☽s hourly Motion (to 2s 22°½ of Anom.) . .	33	00
Suns true hourly Motion	02	23
☽s true hourly Motion from the Sun	30	37

	h	′	″
Interval add	08	48	46
Mean time of the true Conjunction in the Orbit, *July* the second	02	46	15

At which time,

	s	°	′	″
The Suns true place is	♋	20	51	52
The Moons Mean Anomalie	02	26	11	50
The Excentricitie	43862			
The Moons true place	♋	20	51	52
The true place of the ☊	♋	16	30	24
The Argument of Latitude	04	21	28	
The Moons true hourly Motion	00	33	18	
The Suns 2′ 23″: The Moons from the Sun	00	30	55	

	h	′	″
The Equation of days to be subtracted here	00	04	57
Therefore the apparent time of the ☌ in the Orbit at	02	35	18
Time of Reduction subtracted	00	02	11
The apparent time of the nearest approach of the Moon to the Center of the Disk . .	02	33	07
But of the Ecliptical ☌ with the Sun . .	02	37	29

And

		′	″
And the nearest distance of the Moons Center from the Center of the Disk in her passage over it, equal to her Latitude at the time of her Conjunction in the Orbit		22	46
The Moons Horizontal Parallax was then		57	44
The Suns subtracted from it		00	10
Leaves the Semidiameter of the Disk		57	34
The Moons Horizontal Semidiameter		15	40
The Suns		15	50
The Semidiameter of the Penumbra		31	30

The Angle of the Moons way with the Ecliptick 5° 41′, this is equal to the Angle which the Perpendicular to her way formes with the Axis of the Ecliptick; and if the Argument of Latitude be more than 9 Signes or less than 3, the said Perpendicular lies to the left hand, if more to the right from the Axis of the Ecliptick.

To Calculate the times of the principal appearances of a Solar Eclipse under the Meridian of LONDON.

1. To the Semidiameter of the Disk add the Semidiameter of the Penumbra, if the Moons Latitude at the time of the true ☌ in the Orbit be less than this Sum, the Sun will appear Eclipsed somwhere on the Earth, otherwise, not.

And if the said Latitude be less than the Semidiameter of the Disk, the Eclipse will be Central in some places of the Earth, otherwise, no where.

Substract the Semidiameter of the Penumbra from the Semidiameter of the Disk, if the Moons Latitude at the time of the Conjunction be less than this Residue, the intire Penumbra will fall within the Limb of the Disk otherwise not.

2. Convert this difference, the Semidiameter of the Disk, and the Sum above got, severally into Seconds:

Then say,

As the Radius,
To the Moons Latitude in Seconds;
So the Sum of the Semidiameters in Seconds,
To the Co-sine of the first Angle of Incidence.

And, *So is the Semidiameter of the Disk,*
To the Co-sine of the second Angle of Incidence;
And, *So is the Difference of the said Semidiameters,*
To the Co-sine of the third Angle of Incidence.

The

The first Angle of Incidence subtends the Motion of Semiduration of all manner of Eclipses on the Earth; the second the Motion of Semiduration of Central Eclipses; and the last the Motion of Semiduration of the entire Penumbra within the Disk.

Say Again,

As the Radius,
To the sine of the first Angle of Incidence;
So the Sum of the Semidiameters of the Disk and Penumbra,
To the Motion of Semiduration of the whole Eclipses of all sorts.

And, *So the Semidiameter of the Disk,*
To the Motion of Semiduration of Total Eclipses.

And Again,

So the difference of the Semidiameter of the Penumbra and Disk,
To the Motion of the Semiduration of the Penumbra within the Disk, or Semimora.

3. To Convert these Motions into time, say,

As the Moons hourly Motion from the Sun,
To one hour;
So the Motion of any Semiduration,
To the time answering it.

Which subtracted from, or added to the time of the middle Eclipse; or the nearest approach of the Centers of the Moon and Disk, gives the time under the Meridian of our Tables, when the answerable appearances begin or end in other places of the Earth.

In the first Section of this part you were taught how to find the Angle which the Axis of the Earth formes with the Axis of the Ecliptick; and to know on which hand from the Axis of the Ecliptick it lay in the Projection; how to know on which side the said Axis the Perpendicular to the Moons way lies, you have been shewed before: Note now,

If the *Axis of the Globe*, and the *Perpendicular to the Moons way* be both to the same hand, (that is, both to the right, or both to the left from *the Axis of the Ecliptick*) their difference, but if otherways (that is one on the right, and the other on the left) their Sum shall be the Angle, which the Moons Path over the Disk formes with a Parallel to the Equator: This for brevity, wanting a better Term, I call *the Angle of Direction.*

Which if the Inclination of the Axis of the Globe, be less to the right hand or more to the left, than the Inclination of the *Perpendicular to the Moons way*, to the Axis of the Ecliptick; or if the Axis of the Globe

 lying

lying on the left, the Perpendicular fall on the right hand the said Axis of the Ecliptick, *the Angle of Direction shall be Affirmative*; but if the said Inclination be less to the left hand, or more to the right, than the Inclination of the *Perpendicular*; or if the Perpendicular lying on the left, the Axis of the Globe fall on the right hand the Axis of the Ecliptick, *the said Angle of Direction will be Negative*: Mind these Cautions, then say,

As the Radius,
To the Tangent of the Angle of Direction;
So the nearest distance of the Centers of the Moon, and Penumbra at the middle of the Eclipse.
To the Motion betwixt the Axis of the Globe, and the place of the Moons nearest approach to the Center of the Disk.

Find the time answering to this Motion, as you did the time of the Semiduration before; If the Angle of Direction were Negative, this subtracted; If Affirmative, added to the Apparent time of the middle, gives the Apparent time at *London*, when the Meridional Sun shall be Centrally Eclipsed elsewhere.

Example.

	°	′	″
The Semidiameter of the Disk	00	57	34
The Semidiameter of the Penumbra	00	31	30
Their Sum	01	29	04
Their Difference	00	26	04
The first Angle of Incidence	75	11	00
The second	66	42	00
The third	29	08	40
The Motion of Semiduration	01	26	06
Of Semi-centralitie	00	52	52
Of Semi-mora	00	12	41
From the Axis to the nearest approach	00	01	14

	h	′	″
Hence the time of the Semiduration of all manner of Eclipses in the Earths Disk	02	47	06
The time of the Semiduration of all the Central Eclipses in the Earth	01	42	36
The time of the Semi-mora, or the Semiduration of the whole Penumbra within the Disk	00	24	38
The time from the transit by the Axis to the middle	00	02	24

By

By Subtracting and adding these severally (all save the last, which is only to be subtracted) to 2^h 33′ 07″ the time of the middle, or nearest approach of the Moon to the Center of the Disk, I Collect the times at *London*, when,

	h	′	″	
The Penumbra first touches the Disk and the Eclipse first of all begins in the Earth	11	46	01	In the Morning.
The Center of the Penumbra enters the Disk and the Central Eclipses begin	00	50	31	Afternoon.
The Mora begins, or the Penumbra is now first wholly within the Disk	02	08	29	
The Meridional Sun Centrally Eclipsed	02	30	43	
The Nonagesimal Sun Centrally Eclipsed	02	37	29	
The Mora ends, or the Penumbra begins first to Emerge from the Disk	02	57	45	
The Central Eclipses end in the Earth and the Center of the Penumbra passes off the Disk	04	15	43	
The Penumbra passeth off the Disk, and all Eclipses ended in all places of the Earth	05	20	13	
After they have continued in passing over the Earth	05	34	12	

At that place where the Penumbra first enters into the Disk, the Sun appears beginning to be Eclipsed in the Supreme Point of his Vertical Diameter; where the Center of the Penumbra enters it, he appears Centrally Eclipsed in his Rising; and the Eclipse ends as he Riseth in the lowest Point of his Vertical Diameter, in that Point of the Earth where the Penumbra is first totally Immerged within it: where the Line of the Moons way intersects the Axis of the Globe he is Centrally Eclipsed in the Meridian; and where it passeth the Axis of the Ecliptick in the Nonagesime degree.

Where the Penumbra first begins to Emerge from the Disk, the Eclipse is beginning in the lower Extremity of his Vertical Diameter as he sets; where it Cuts the Disk again he happens Centrally Eclipsed in his setting; and where it wholly leaves the Disk, the Eclipse ends in the upper Extremity of his Vertical Diameter as he passeth the Horizon.

F To

To determin the Latitudes of those places on the Globe, and their Longitudes from London, *where any of those appearances happen.*

If the Angle of Direction be Negative, subtract it from, otherways add it to the Angles of Incidence, the Residue shall be the Amplitudes of those Paths in the Horizon of the Disk, which the Penumbra touches in its first Entrance, when its Center enters, and when tis first totally within: Add the same Angle to the Angles of Incidence when Negative, subtract it when Affirmative, makes the Amplitudes of those Paths in the Horizon of the Disk, whereon the Penumbra first begins to Emerge from the Disk, where its Center Emerges, and where it last touches it as it passeth off.

Say Then,

As the Radius,
To the sine of the Suns distance from the Pole;
So the Co-sine of the Amplitude of any Path,
To the Co-sine of its Latitude.

Which if the Amplitude of the Path be less than 90 Degrees, is North of the Equator, otherways, South:

Say Again,

As the Co-sine of the Suns distance from the Pole,
To a Radius;
So the Tangent of the Amplitude of any Path,
To the Tangent of the hour of Sun Rise, or Sun Set in that Latitude.

Which if the Suns distance from the Pole be less than 90 Degrees and the Latitude North; or more than 90, and the Latitude South, is to be accounted from Midnight, otherways from Noon.

But to find in what Latitude the Meridional Sun shall be Centrally Eclipsed.

Say First,

As the Co-sine of the Angle of Direction,
To a Radius,
So the Moons distance from the Center of the Disk in the middle of the Eclipse,
To the distance in the Axis.

And Again,

As the Semidiameter of the Disk,
To the sine of 90 Degrees;
So the Distance of the Moons Center from the Center of the Disk, as she passeth over the Axis of the Globe.
To the sine of the Arch of the Meridian betwixt the Sun and Vertex.

Which

Which if the Moons Latitude at the ☌ were North, subtracted from, if South added to the Suns distance from the Pole of the Globe, makes the distance of the Point on the Earth from the said Pole, of which, if less than 90 degrees, the Complement to 90 is the Latitude North; if more the excess shews the Latitude South.

And if the Arch of the Earth be more than the Suns distance from the Pole, the Pole it self is Eclipsed, and the Complement of the Latitude shall be their difference.

Take the Sum and difference of the Moons distance from the Center of the Disk, and the Semidiameter of the Penumbra, work by the same Proportion, and you will find the Arches of the Earth answering to them, and the places where the Meridional Sun was touched, either on his upper or under Limbe by the Moon as she passed by him.

If the place where the Moon shall be Centrally Eclipsed in the Nonagesime degree be required, having her distance from the Center of the Disk, she transits the Axis of the Ecliptick:

You may say again,

As the Semidiameter of the Disk,
To a Radius;
So the Moons distance from the Center of the Disk in her transit,
To the sine of the Suns distance from the Vertex in the Nonagesime. Which obteined,

Say,

As the Radius,
To the Co-sine of the Inclination of the Axis of the Earths Globe to the Axis of the Ecliptick;
So the Tangent of the Suns distance from the Vertex,
To the Tangent of a fourth Arch, which taken from the Suns distance from the Pole leaves a fifth.

Say Now,

As the Co-sine of the fourth Arch,
To the Co-sine of the fifth;
So the Co-sine of the Suns distance from the Vertex,
To the sine of the Latitude of the place.

Say again,

As the sine of a fifth Arch,
To the sine of the fourth;
So the Tangent of the Inclination of the Axes,
To the Tangent of the hour from Noon when the Sun will be in the Nonagesime.

Note,

Note, that if the Axis of the Globe be to the right hand from the Axis of the Ecliptick, the hour is before Noon, if to the left, Afternoon.

For Example.

	°	'	"
The Inclination of the Axis of the Globe to the right hand from the Axis of the Ecliptick in the Disk	08	48	00
The Angle which the Perpendicular to the Moons way formes on the right hand with the Axis of the Ecliptick . .	05	41	00
Their difference the Angle of Direction Negative . .	03	07	00
Which therefore subtracted from the first Angle of Incidence	75	11	00
Leaves the Amplitude of that Path of that Vertex in the Horizon of the Disk, which the Penumbra first touches in its entrance	72	04	00
Hence the Latitude of that place	16	36	Nor.

	h	'	"
The time of the Suns rising there	05	32	31
The time then at *London*	11	46	01
The Difference equal to the Difference of Meridians	06	13	30

	°	'
And the place to the West of *London*, ...	93	22½

Where the Eclipse first begins at Sun Rise, in which Latitude and Longitude from *London*, lies the Golf of *Hondura* in *America*, where the Eclipse will begin in the Suns upper Limb as he Riseth.

	°	'	"
The Angle of Direction	03	07	00
Contrary to its Title added to the Angle of Incidence .	75	11	00
Makes the Amplitude of that Path in the Disk which the Penumbra last touches, when it leaves the Earth . .	78	18	00
Hence the Latitude of that Point	10	51	Sou.

	h	'	"
The time of the Suns set there	06	17	39
The hour at *London* then Afternoon	05	20	13
The difference equal to the difference of Meridians	00	57	26

	°	'	"
Therefore the place to the East of *London*	14	21	30

Under

Under which Position lies *Zanfora* in *Egypt*, whereabouts the Eclipse will be seen ending in the supreme part of the Suns Vertical Diameter, as he Sets. *Where the Eclipse last ends at Sun Set.*

	°	'	"
The second Angle of Incidence is	66	42	00
The Angle of Direction Subtract	03	07	00
The Amplitude of that Path which the Center of the Penumbra touches, when it enters the Disk	63	35	00
Hence the Latitude of the place	24	23	Nor.

	h	'	"
The time of the Suns Rise in that Latitude	05	18	05
The time at *London* then Afternoon	00	50	31
The Difference of Meridians	07	32	26

	°	'	"
Therefore the place to the West of *London*	113	06	30

Which position agrees with New *Spain* in *America*, where the Sun will be Centrally Eclipsed at his Rising. *Where the Sun Riseth Centrally Eclipsed.*

	°	'	"
The Sum of the second Angle of Incidence and Direction make the Amplitude of that Path which the Center of the Penumbra last touches, when it leaves the Disk . . .	69	49	00
The Latitude therefore of that Point North	18	40	00

	h	'	"
The time of Sun Set in that Latitude	06	31	11
The time then at *London* Afternoon	04	15	43
The Difference of Meridians	02	15	28

The place therefore to the East of *London*	33	52	00

Under which Position lie the Southern parts of Egypt, where the Sun Sets centrally Eclipsed. *Where the Sun Sets Centrally Eclipsed.*

The Difference of the Angle of Direction, and third Angle of Incidence, makes the Amplitude of the Path of that Vertex in the Horizon of the Disk, which the Penumbra last touches when tis Totally immersed in it, 26° 01'

Hence the Latitude of that Point	56	30

	h	'	"
Time of Sun Rise in that Latitude at	03	30	39
Time then at *London* Afternoon	02	08	29
The Difference of Meridians	10	37	50

And the place to the West of *London*	159	27½

H The

Where the Eclipse ends at Sun Rise.

The place under the Latitude and Longitude from *London*, falls in the Western Ocean, to the West of *the Streight of Anian*, (if any such) and there the Eclipse ends at Sun Rise, in the lowest Point of his Vertical Diameter, this is the most Western place that sees the Eclipse.

	°	′	″
The Sum of the Angle of Direction and the third Angle of Incidence makes the Amplitude of the Path of that Vertex whereon the Penumbra first begins to Emerge from the Disk	32	15	00
Therefore the Latitude of that place	51	43	

	h	′	″
The time of Sun Set there	08	02	12
The hour then at *London* Afternoon	02	57	45
The Difference of Meridians betwixt *London* and it .	05	04	27
Therefore the place to the East of *London*	76	07	

Where the Eclipse begins at Sun Set.

Under which Position on the Globe lie the Southern parts of *Caracathay*, where the Eclipse begins in the lowest Point of the Suns Vertical Diameter, as he Sets, this is the most Eastern of all those places where any part of the Eclipse of the Sun is seen.

	°	′	″
The distance of the Penumbra from the Center of the Disk in the place where the Path intersects the Axis . . .	00	22	48
The Arch in the Meridian of the Earth under it is . . .	23	19	
The Suns distance from the Pole	68	08	
Their Difference, or the Complement of the Latitude . .	44	49	
Therefore the Latitude North	45	11	

	h	′	″
Time there is Noon, at *London* Afternoon . .	02	30	43
So the place to the West of *London*	37	41	

Where the Sun is Centrally Eclipsed in the Meridian.

And the Sun Centrally Eclipsed in the Western Ocean about the *Azores*, in the Meridian, or at Noon.

	°	′	″
The Sum of the Semidiameter of the Penumbra and the distance of its Center from the Center of the Disk in its passage	00	54	14
The Arch in the Meridian answering it	70	24	
Exceeds the Suns distance from the Pole	02	16	

Where the Suns lower is just touched by the Ds upper Limb, in the Meridian.

The Eclipse therefore extends beyond the Pole, and in the Latitude of 87° 44′, the Moons upper Limb just touches the lower Limb of the Sun in the Northern Meridian.

The

	°	′	″
The Semidiameter of the Penumbra exceeds the distance of the Moons Center, from the Center of the Disk in her passage over the Axis	00	08	46
The Arch of the Meridian answering it *South of the Sun*	08	45	
Added to the Suns distance from the Pole makes . . .	76	53	
Therefore the Latitude North	13	07	

Where the South touches the Suns Northern Limb in the Meridian.

Where under the same Meridian passing a little to the West of the *Azores*, the Northern Limb of the Sun is just touched by the Moons Southern, which place falls in the Western Ocean betwixt the Islands of *Cape Verde* and the *Caribee's*.

	°	′	″
The distance betwixt the Center of the Disk, and the place where the Moons Path intersects the Axis of the Ecliptick is	00	22	52
The Arch of the Earths Globe under it	23	25	

	h	′	″
The time when the Center of the Moon passeth it Afternoon	00	19	41
The time at *London* then Afternoon	02	37	29
The Difference of Meridians	02	17	48
Therefore the place to the West of *London*	34	27	
The Latitude of that place	45	04	

Where the Sun is Centrally Eclipsed in the Nonagesime or highest Point of the Ecliptick.

Where the Nonagesimal Sun is Centrally Eclipsed; that is something more Westerly than the place where he was Centrally Eclipsed in the Meridian.

SECTION V.

THat the reason of the foregoing Calculus of the General Phases of a Solar Eclipse may be evident to the Ingenious Reader; I shall here shew how this may be represented by an easy Delineation in *Plano*.

Let ⊙ represent the Center of the Disk, take ⊙B from a Scale of equal parts, or from the Line of Lines on a Sector, equal to its Semidiameter 57′34″, and therewith setting one Foot of the Compasses on ⊙, strike a Circle; this shall represent the *Limb* or *Horizon of the Disk*, projected on a Plane Coincident with the Moons way, at right Angles with the Line Connecting the Centers of the Sun and Earth. *Fig. 7.*

Through ⊙ draw the Diameter *e*⊙π continuing it both ways without the Disk. This shall be the Line I call *the Axis of the Ecliptick*, and the Point *e* where it Intersects the upper part of the Limb of the Disk its *Northern Pole*.

The

From the same Scale of equal parts, or the same Line of Lines on the Sector open to the same Angle, take off the Semidiameter of the Penumbra 31′ 30″, and set it off on the Axis of the Ecliptick from *e* to *A* and *x*, through which Points, with one Foot of the Compasses on the Center ⊙, strike Circles; the Semidiameter of the Larger ⊙ A shall be 01° 26′ 04″ *the Sum*, ⊙ *x* 26′ 04″ *the difference of the Semidiameters of the Disk and Penumbra.*

The Inclination of the Perpendicular to the Moons way to the Axis of the Ecliptick, I have before determined 05° 41′ on the right hand. Make therefore ⊙ *e* (the Semidiameter of the Disk) the Radius of a Line of Chords, and taking from the same, the Chord of the Inclination 05° 41′, set it off from *e* the Pole of the Ecliptick to *z* that way; from the Center ⊙ draw the Line ⊙ *z*, this shall be *the said Perpendicular to the Moons way.*

From the forementioned Scale of equal parts take 22′ 46″, the nearest distance of the Line of the Moons way from the Center of the Disk; which if North, as here, set it off in the said Line from ⊙ to *m* Northwards (otherways on the contrary side the Center towards A) through *m* draw the Line *n m f* at right Angles to ⊙ *z*, this shall be the *Line of the Moons way over the Disk, or the Path of the Penumbra.*

To the Points *n k t v q* and *f*; where the Path of the Penumbra intersects the Circles before described, draw streight Lines from the Center ⊙, producing ⊙ *t* and ⊙ *n* till they reach the Limb of the Disk in *r* and *s*, so have you in the Antecedent Limb of the Disk, First the Point *n*, the place of the Moons Center, when the Penumbra first touches the Limb of the Disk in *b*, whence the Rising Sun appears beginning to be first Eclipsed in the supreme Point of his Vertical Diameter: Secondly the Point *k*, where the Center of the Penumbra enters the Disk, and the Sun appears Centrally Eclipsed in his Rising: Thirdly *t*, the place of the Moons Center, when the Penumbra is got wholly within the Disk, and *r* the place in it where the Eclipse at that time ends, in the lowest Point of the Suns Vertical Diameter, as he Riseth: Fourthly N the Point under which the Sun is Centrally Eclipsed in the Nonagesime, or totally if the Suns Semidiameter be less than the Moons. And in the Consequent Semi-Circle; Fifthly *v* the place of the Moons Center when the Penumbra begins to Emerge from the Disk, and *s* the Point in the Disk where it Emerges, and whence the Eclipse appears beginning in the Suns lowest Limb, as he Sets: Sixthly *q*, where the Center of the Penumbra Emerges from the Disk, and the Sun appears Centrally Eclipsed in his Setting: Seventhly *f*, the place of the Moons Center when the Penumbra leaves the Disk; and *g* the Point whereon it Emerges, the Eclipse ending there in the Vertical Point of the Setting Sun.

And now we have formed three pair of Triangles: First, *m* ⊙ *n* = *m* ⊙ *f*, in which is given ⊙ *n* = ⊙ *f*, the Sum of the Semidiameters of the Penumbra and Disk, and ⊙ *m* the nearest distance of the Path of the Penmubra from the Center of the Disk, and the Angle at *m* right; to find *m* ⊙ *n* = *m* ⊙ *f the first Angle of Incidence*, with *m n* = *m f the Motion of the Semiduration of all manner of Eclipses*, which will be easily obtained by the forementioned proportions.

Secondly,

Secondly, In the Triangles *m k* ⊙ = *m q* ⊙, are given ⊙ *k* = ⊙ *q* the Semidiameter of the Disk, with *m* ⊙ as before, to find *m k* ⊙ *the second Angle of Incidence* equal to *m q* ⊙; and *m k* = *m q the Motion of the Semiduration of Central Eclipses.*

Thirdly, In the Triangles *m v* ⊙ = *m t* ⊙, are known ⊙ *t* = ⊙ *v*, the Difference of the Semidiameters of the Disk and Penumbra with ⊙ *m*, as before; whence *m t* ⊙ = *m v* ⊙, *the third Angle of Incidence*; *m t* = *m v* = *the Motion of Semimora* will be easily had; which Arches *m i* = *m f*, *m k* = *m q*, *m t* = *m v*, being turned into time, and the times answering them subtracted from and added to the middle of the Eclipse, or the Moment the Center of the Penumbra is at *m*, gives the several times when the said Center shall be at *n k t v q f*; or the times of general Phases of the Eclipse belonging to those places at *London.*

Or the time when the Center of the Penumbra shall arrive at the said Points, may be otherways Mechanically investigated thus. The middle of the Eclipse, or the time when the Moons Center will be at *m*, happens at 33′ 07″ past two a Clock Afternoon: Say, As 1 *Hour or* 60 *Minutes*, to 30′ 55″ *the hourly Motion of the Moon from the Sun*: So is 33′ 07″ *the time more than* 2 *Hours Afternoon*, to 17′ 02″ *the Motion from* 2 *a Clock to the middle.*

From the same Scale wherewith you laid off the Semidiameter of the Disk $57'\frac{34}{60}$, take $17'\frac{2}{60}$ of the same parts betwixt your Compasses, and setting one Foot on *m*, with the other make a Point in the Line of the Moons way on the Right-hand; this shall be the place of the Center of the Penumbra at 2 a Clock Afternoon at *London*, and is therefore noted here with the Number II.

The hourly Motion of the Moon from the Sun, is 30′ 55″; take therefore from the same Scale of equal parts $30'\frac{55}{60}$ betwixt your Compasses, and setting one Foot on II, with the other make Points on each side it in the Line of the Moons way; these shall shew the place of her Center in it at the hours of I and III: And if from these Points you farther set off the said extent, in the said Line you may thereby find the place of the Moon in the same Line for every hour, whilst the Penumbra shall touch the Disk: Divide the space betwixt every hour into 60 parts, so have you the place of the ☽s Center in the Line of her way to every single Minute of time.

After this manner was the Line of the Moons way drawn and divided in the Eighth Figure, whereby the times when the Moons Center comes upon any of the forementioned Points, will be found the same as by Calculation.

The Angle *m* ⊙ *n* is equal to the Arch *z b*, *m* ⊙ *k* to *z k*, and *m* ⊙ *t* to *z r*; to each of which the Arch *e z* (which according to *Kepler* is not more than 5° 18′) in the Case before us being added, makes the Arches *e b*, *e k*, *e r*, but subtracted from them gives *e g*, *e q*, *e s* the Altitudes of the Nonagesime Degree in those places at Sun Rise or Sun Set; with which and the Suns true place or the opposite Point, as the Case happens, that Ingenious Person entring his Nonagesimary Table finds the Latitude of the Points

b

b k r s q g, and thence the right Aſcenſion of the Midheaven at the time of the Sun Riſing or Setting in thoſe places, whoſe difference from the right Aſcenſion of the Midheaven when the Penumbra is on any of the ſaid Points under the Meridian of his Tables, gives the Longitude of thoſe places thence, to the Eaſt if it were more, to the Weſt if leſs than the right Aſcenſion of the Midheaven at the place to which his Number are fitted.

It was I conceive the greateſt ſucceſs which the diligent Endeavours of this Famous Perſon met with in Correcting of the Planetary Motions, that cauſed him to employ the greateſt part of his time and pains about them; ſo that having found how the uſual Imaginary Circles of the Sphere might be projected in the Copernican Syſtem, and all the Diurnal Appearances of the Sun and Stars ſalved by them; he contented himſelf to ſhew this, and never enquired how they were Naturally formed, and might be more eaſily repreſented without the help of any ſuch Fictitious Circles; as I have before ſhewn; elſe he had never miſt of a better Method, whereby without the help of any Nonageſimary Table, the Latitudes and Longitudes of thoſe places on the Earth from the Meridian of his Tables, where the principal Appearances of a Solar Eclipſe ſhall happen might be inveſtigated, and which I ſhall here ſhew.

Fig. 7. The Inclination of the Earths Axis to the Axis of the Ecliptick, I have allready found in the firſt Section of this part 8° 48′ on the right hand; ſet off accordingly 8° 48′ in the Limb of the Disk, from *e* the Pole of the Ecliptick on the right hand to *i*, and by the Point ſo found draw the Line *i* ⊙ *a* through the Center of the Ecliptick, this ſhall be the Axis of the Earth projected in it.

The Inclination of the Perpendicular to the Moons way to the Axis of the Ecliptick, I have before determined 5° 41′ to the ſame hand equal to the Arch *e z* which taken away from *e i*, leaves *z i* equal to *z* ⊙ *i the Angle of Direction* 3° 07′.

Which according to the Cautions of the Preceding Section is Negative; and therefore ſubtracted from the Arch *z b* leaves *i b* the Amplitude of that Path in the Horizon of the Disk whence the Eclipſe is ſeen beginning in the Vertical Point of the Riſing Sun; from *z k*, leaves *i k* the Amplitude of that Path whence the Eclipſe is ſeen Central at Sun Riſe; but taken from *z r*, the Reſidue *i r* will be the Amplitude of that, wherein the Eclipſe ends in the loweſt Point of the Riſing Sun.

But if on the Contrary the Arch *z n* be added to *z s*, it makes *i s* the Amplitude of the Path, whence the Eclipſe is ſeen beginning in the loweſt Limb of the Setting Sun; to *z q* it gives *i q*, the like Amplitude of the Path of that Vertex, in which the Eclipſe appears Central at Sun-ſet; but added to *z g*, the Sum *i g* will be the Amplitude of that Path, in which the Eclipſe ends in the higheſt Point of the Suns upper Limb as he Sets.

In the ſame Seventh Figure let P repreſent the North Pole of the Globe, whoſe place in the Axis is determin'd by the directions of the firſt Section; from which Imagin Hour-circles drawn to *b k r s q g* in the Disk; the Angles which thoſe Hour-circles ſhall form with the proper Meridi an ⊙ P, ſhall be

be the hours at which the Sun riſes or ſets in any of thoſe Paths, and the Arch of any Meridian betwixt the Pole and any of the ſaid Points ſhall be the diſtance of the Path from the Pole, or the Complement of the Latitude of the place upon that Point. Let B in the Eighth Figure repreſent any of the ſaid Points, and let the Hour-circle P B be drawn; In the Right-angled Triangle P B *i* are given, P *i* the Complement of the Suns diſtance from the Pole equal to the Reflection; *i* B the Amplitude of the Path, and the Angle at *i* right, whence either P B the Diſtance of the Path from the Pole, or B P *i* the hour of Sun riſe or ſet will be found by the known Reſolutions of Right-angled Triangles; which laſt whether it be to be Numbred from Noon or Midnight, the cautions of the laſt Section teach. Fig. 8.

To find the place where the Sun will be Centrally Eclipſed in the Meridian: In the ſmall Triangle *m* ⊙ *p* are given *m* ⊙ as before, *m* ⊙ *p* the Angle of Direction, with the Right-angle at *m*, whence the Arch *m p* intercepted betwixt the Earths Axis, and the Perpendicular to the Moons way, and conſequently the time betwixt the Meridional Eclipſe, and the middle will be found, as alſo ⊙ *p*, and the Arch of the Globe under it; Say, As *i* ⊙ . *s* 90° :: ⊙ *p*: *to the ſine of the Arch of the Earths Globe under it*; which in this Caſe ſubtracted from ⊙ P leaves P B, the Complement of that Latitude, under which the Sun is Centrally Eclipſed in the Meridian.

The Semidiameter of the Penumbra is 31′ 30″; ⊙ *p* 22′ 48″ added to it makes 54′ 18″; ſubtracted from it leaves 8′ 42″, which converted into Arches on the Earth by the foregoing Ratiocination, and thoſe added to, and ſubtracted from the Suns Diſtance from the Pole ⊙ P, makes the Complements of thoſe Latitudes, wherein the Suns under and upper Limb are onely touched by the ☽s in her Tranſit, as in the Example.

But if the Time when, and the place where the Moon ſhall appear totally Eclipſed in the Nonageſime Degree be required, in the Triangle N *m* ⊙ Right-angled at ⊙, are known the Angle N ⊙ *m* which the Perpendicular to the Moons Path makes with the Axis of the Ecliptick, and the Angle at *m* right, whence the Motion betwixt the middle, and the Tranſit of the Axis of the Ecliptick N *m*, will be eaſily found, together with N ⊙, and the Arch of the Earths Periphery under it.

Imagin an Arch of an Hour-circle P N ſtrook through the Pole and this Point N, then in the Oblique-angled Triangle N P ⊙ are known the Arch N ⊙, the Diſtance of the Nonageſimal Sun from the Vertex, ⊙ P the Suns Diſtance from the Pole, with the Angle ⊙ N P the Inclination of the Axis of the Globe to the Axis of the Ecliptick, whence N P the Complement of the Latitude, or the diſtance of the Vertex, where the Sun is Centrally Eclipſed in the Nonageſime, from the ſaid Pole; together with the Angle N P ⊙, or the hour (Afternoon in this Caſe) when the Sun ſhall be in the Nonageſime will be had.

After the ſame manner it might eaſily be determin'd under what Latitudes and Longitudes from the Meridian of our Tables, the Suns upper or under Limb ſhould be only touched by the Moons in the Nonageſime Degree, or more Points might be found on the Globe; through which a Line drawn ſhews

ſhews all the places where the Eclipſe would appear Central, or the greateſt nearly of any given Number of Digitts.

If it were required to know the Longitude of that *place* from *London*, and its Latitude, where the Sun ſhall be Centrally Eclipſed, when 'tis here two hours Afternoon, the time propoſed is 33′ 07″ before the middle of the Eclipſe at *London*: Say then, As 1 *Hour* to 30′ 55″ *the hourly Motion*: So 33′ 07″ to 17′ 02″, *the Motion from* 2 *Hours Afternoon*, *to the middle*, *or from* II to *m*.

To II draw the ſtreight Line ⊙ II; then in the Triangle *m* ⊙ II, are given *m* ⊙ and *m* II, whence the Angle *m* ⊙ II will be found 36° 48′; and ⊙ II 28′ 26″; but the Arch of the Earths Periphery under it 29° 36′, the Diſtance of the Vertex under that Point from the Sun.

From the Pole P, let the Arch of an Hour-circle be drawn through II, ſo in the Oblique-angled Spherical Triangle ⊙ P II are known, ⊙ P the Suns Diſtance from the Pole 68° 08′, which ⊙ II the Suns Diſtance from the Vertex 29° 36′, and the Angle Interjacent P ⊙ II 36° 48″, whence P II the Complement of the Latitude will be found 46° 18′; therefore the Latitude of that Point 43° 42′ North.

But the Angle ⊙ P II, or the hour before Noon 24° 09′ $\frac{1}{2}$ = to 1h 36′ 38″; the true time therefore at that place will be 10h 23′ 22″ in the Morning, which taken from 2 hours Afternoon leaves 3h 36′ 38″ = 54° 09′ $\frac{1}{2}$, the Longitude of that place to the Weſt from *London*.

SECTION VI.

TO determin the Apparent Time of the beginning or end of Solar Eclipſe, the Time when the Sun ſhall be Eclipſed to any poſſible Number of Digitts, the Inclination of the Cuſps of the Eclipſe, and the Time of the viſible Conjunction of the Luminaries in any given Latitude.

In the firſt Section of this part, I have ſhewed how the *Path of any Vertex* may be deſcribed in the Disk, and for an Example, I have delineated the Path of the Vertex of *London*, at the time of this Eclipſe of the Sun in the Eighth Figure which is the Ellipſis *d m f*.

In the foregoing or Fifth Section I have ſhewed how the Line of the Moons way, or Path of the Penumbra may be drawn and divided, which is alſo done according to the precepts there delivered, in the ſaid Figure Eight.

In the ſame Figure I have drawn two other Paths, the middle L E O for the Latitude of 36° 03′ North, which will fit *Aleppo* and all other places under that Latitude; the other I A B for the Latitude of 17° 30′ North, under which lies the Iſland of *Jamaica*, where I deſire to know at what time the Beginning of this Eclipſe, the viſible Conjunction of the Luminaries, and the End of it will happen.

Take

Take betwixt your Compaſſes the Semidiameter of the Penumbra 31′ 30″, from a Scale of ſuch equal parts as the Semidiameter of the Disk was ſet off or meaſured by, that is 57$\frac{14}{60}$, and carrying one Foot along the Line of the Moons way from the right hand to the left, find a Point in it, upon which if that Foot be ſet the other turn'd about ſhall Cut the ſame hour in the Path of the Vertex that this ſtands upon: The Point in the Path upon which the fixed Foot then ſtands ſhall ſhew the time of the beginning of the Eclipſe.

Carry on the ſame Foot of your Compaſſes ſtill more to the left hand, and find another Point in the Line of the Moons way, whereon if you fix one Point of your Compaſſes, the other ſhall cut the ſame hour in the Path of the Vertex which this ſtands upon in the Line of the Moons way, the Point on which your Compaſſes ſtand ſhall ſhew the Minute the Eclipſe ends, if the Scheme admit Minute Diviſions.

By the help of a Square of which one ſide may be apply'd and carried cloſe along the Ecliptick ♈ H, another Point may be found in the Path of the Vertex, whence a Line drawn by the Perpendicular edge of the Square, ſhall cut the ſame time in the Line of the Moons way, it marks in the ſaid Path of the Vertex; this ſhall be the time of the viſible Conjunction of the Luminaries.

Thus carrying the Semidiameter of the Penumbra betwixt my Compaſſes with one Foot in the Line of the Moons way, I find that when it comes to α at 8′ after II hours, the other if turn'd about will cut the ſame time in the Path of the Vertex at δ, this therefore is the time of the beginning of the Eclipſe at *London*.

Draw the Line α δ, and from ⊙ the Line ⊙ δ, this ſhall repreſent the Vertical Circle; and the Angle ⊙ δ α which theſe two Lines form ſhall be the Angle which the Vertical Circle ſhall make with the Line connecting the Centers of the Sun and Moon at the beginning of the Eclipſe.

If the Compaſſes be kept at the ſame extent, and one Point carried forward in the Path of the Penumbra, when it comes to γ at 26$\frac{1}{2}$ paſt IIII, the other Point turn'd about will cut the ſame hour in the Path of the Vertex at ε, wherefore the Eclipſe then ends at *London*.

Draw γ ε, and from the Center of the Disk ⊙ ε, the Angle ⊙ ε γ ſhall be that which the Vertical Circle ſhall form with the Line connecting the the Center of the Luminaries, at the end of the Eclipſe.

And if the edge of a true Square be carried cloſe along the Line H *r*, when the Perpendicular ſide cuts the Path of the Penumbra in β at 21 after III, it alſo cuts the ſame hour in the Path of the Vertex at *s*, this therefore is the time of the viſible Conjunction, *s* the place of the Vertex or the Suns Center, β the Moons place in her Orbit.

Take the Semidiameter of the Sun from the ſame Scale, whereby you laid off the Semidiameter of the Disk, betwixt your Compaſſes, and therewith on the Center *s* deſcribe a Circle, this ſhall repreſent the Sun, and with the Moons Semidiameter betwixt your Compaſſes taken from the ſame Scale, on the Center β deſcribe another Circle, this ſhall cut off from the

I former

former so much as the Sun shall be Eclipsed at the time of the visible Conjunction.

From ☉ draw the Line ☉ s ζ, this shall represent the Vertical Circle, ζ the Vertical Point in the Sun, whereby the position of the Cusps of the Eclipse in respect of the Perpendicular through the Suns Center, are plainly and easily obteined.

Produce θ s till it intersect the Moons Limb in θ, then shall n θ the greatest distance of the Limbs of the Sun and Moon, be the parts Eclipsed, which if the Suns Diameter be divided into 12 equal parts shall be equal to $7\frac{2}{5}$ of them, and so many are the Digits Eclipsed at the greatest Obscuration nearly.

Hence at London,

	h. m.	
The beginning of the Eclipse *July* 2^d 1684. at	02 08	Afternoon,
The visible Conjunction of the Luminaries	03 21	Digits then $7\frac{2}{5}$;
The end	04 $26\frac{1}{3}$.	

And the position of these Appearances in respect of the Vertical Circle passing the Suns Center, as in the Ninth Figure.

If it were required to know at what time the Eclipse shall begin and end at *Aleppo*; the Arch of the Ellipsis L E O is the Path of that place, and the Path of the Penumbra is the same for all places of the Earth.

But the Times will be to be Numbred differently in it, according to the Difference of the Meridian of any place from *London*, for if the place given lie to the East, the hours in the Moons Path will be to be reckoned so much more; if to the West so much less, as is the difference of Meridians.

Aleppo is usual accounted 02^h 20′ to the East of *London*, the middle therefore which at *London* will be $2^h 33' 07''$ Afternoon, shall be $04^h 53' 07''$ Afternoon at *Aleppo*; and all the hours marked in the Path will be accounted 02^h 20′ more than they are noted, with the large Figures.

Wherefore on the upper side of the Line of the Moons way, I have noted in small Figures the place of her Center in the Path at every hour; so that hence it will be easy to find her place in the Path to any Minute required.

And now carrying the Semidiameter of the Penumbra, betwixt my Compasses along the Line of her way; I find that when one Foot comes to λ at 05 h. 19′ reckoned for *Aleppo*, the other will cut the same hour in the Path of the Vertex at *x*, this therefore I pronounce the time of the beginning of the Eclipse there.

And when the same carried on comes to π at 6 h. $17'\frac{1}{2}$, there a Line drawn Parallel to the Axis of the Ecliptick, or Perpendicular to the Ecliptick it self will cut the same hour in the Path of the Vertex at ρ; this therefore is the time of the visible Conjunction of the Luminaries, the distance of their Centers then π ρ.

Carrying the same Foot of the Compasses at the same extent forward along the Line of the Moons way, I find that when at 07 h. 08′ the same Foot stands upon *s*, the other cuts the same hour in the Path of the Vertex where it intersects the Limb of the Disk, this therefore I conclude the end of the Eclipse, just at Sun-set.

Therefore at Aleppo,

	h. m.	
The beginning of the Eclipse	05 $19\frac{1}{2}$	Afternoon,
Visible Conjunction	06 $17\frac{1}{2}$	Digits then 7;
End at Sun-set	07 08.	

And the bearing of each of these Appearances as in the Tenth Figure.

If the time of these Phases at *Jamaica* be demanded the Arch of the Ellipsis I A B represents the Path of that place, whose Meridian is accounted 5 hours to the West of ours, so that when 'tis Noon with us, tis to the Inhabitants there only 7 a Clock in the Morning: and the middle of the Eclipse, which with us is at 2 h. 33′ Afternoon, to them will be at 9 h. 33′ before Noon; Wherefore on the under side of the Line of the Moons way, I have noted the hours 5 less than at *London*, so that the Divisions Numbred by them shew the place of the Moons Center to any given time during the Eclipse at *Jamaica*.

Let the Semidiameter of the Penumbra be carried along this Line as in the foregoing Examples, the standing Foot being at μ upon 6 h. $55'\frac{1}{2}$ in the Path of the Penumbra, the other at ν will cut the same hour in the Path of the Vertex; a Line drawn from σ at 08 h. 05′ will cut the same hour in the Path of the Vertex at τ, the distance of the Centers of the ☉ and ☽ at that time being σ τ: And if with the Compasses at the former extent we seek another Point in the Line of the Moons way, whereon if one Foot standing, the other turn'd about will cut the same time in the Path of the Vertex; we shall find it at ξ at 08 h. 59′, and the place of the Vertex at ο.

Wherefore at Jamaica,

	h. m.	
The beginning at	06 55	in the Morning,
The visible Conjunction	08 05	Digits then $4\frac{1}{3}$;
The End	08 59.	

And the position of these appearances as in the Eleventh Figure.

If it be required at what time any possible Number of Minutes or Digits, shall be Eclipsed in the Suns Antecedent or Consequent Limb at any Place; Let the Suns Diameter be accordingly divided into Minutes or Digits, and subtracting or Cutting off the parts required to be Eclipsed from the Semidiameter of the Penumbra, take the remaining part of it betwixt your Compasses, and carrying it along the Line of the Moons way find the first Point in it, on which placing the one Foot, the other turn'd about will Cut the same hour the fixed Foot stands upon; the hour and Minute in the Path on which the fixed Foot stands shall be the time of that Ob-

Obscuration. If for Example it were demanded at what time 3 Digits, or one fourth part of the Suns Diameter, should be Eclipsed in his Antecedent Limb at *London*; cutting off $\frac{1}{4}$ of the Suns Semidiameter from the Semidiameter of the Penumbra, and carrying the rest as directed, I find it 2^h $29'\frac{1}{2}$ in the Line of the Moons way, when the one Point of the Compasses standing on that Time, the other will cut the same accounted in the Path of the Vertex; and therefore this shall be the time of that Eclipse in the Suns Antecedent Limb at *London*.

Whence we have a very ready way given for finding the Difference of Meridians betwixt any two places, whose Latitudes are known, from the like Observation of the same Solar Eclipse, which will not be difficult if the time and quantity of the Eclipse observed under the Meridian of the Tables, shall happen to be the same the Calculus and Construction shews; for suppose the Eclipse shall happen as it is predicted at *London*; but at *Jamaica* the end shall appear at 9^h $20'$ in the Morning; the place of the Vertex in the Path of *Jamaica* at that time will be found at v, take the Semidiameter of the Penumbra betwixt the Compasses and setting one Foot on v, with the other strike an Arch cross the Line of the Moons way at φ, this cuts it 2^h $4'$ Afternoon at *London*; which shall be 9^h $20'$ in the Morning at *Jamaica*, therefore the difference of Meridians betwixt *Jamaica* and *London* (if it shall so happen) will be the difference of these Times, that is onely 4 h. 44′.

But if the Time at *London* shall be found different from what the Calculation has given, and the Digits Eclipsed more or less than it represents, the Latitude of the Path ⊙m must be made more or less accordingly; till the Digits Eclipsed at the visible Conjunction shall be found the same with what the Observation requires.

For the Semidiameter of the Disk, the Suns, and Moons, with their hourly Motions are found by Experience so nearly agreeable to Observation, that they will admit of little or no alteration, the sensible defects of our Tables are only in the Moons Latitude and place, of which the first being correct, the latter may also be easily amended.

For the Latitude of any place being given, and the time of the beginning, end, or any Phases of an Eclipse, the place of the Vertex in the Disk at that time may be laid down by the Method of the first Section.

The Semidiameter of the Penumbra, or the parts of it not Eclipsed, if some Appearance were given, may be made by taking the parts deficient from the Semidiameter of the Penumbra.

Then taking it or the remaining parts betwixt your Compasses, set one foot on the Point of the Vertex, and turning the other about make a stroke through the Line of the Moons way, the Point there Cut shall be the place of the Moons Center at that time, whence the Line of the Moons way may be divided.

And then the time of any Appearance, in a distant place whose Latitude is known, being given, the difference of Meridians betwixt that, and the Meridian of the Tables, or any other known place will be easily found, as the difference of Meridians betwixt *Jamaica* and *London*: The Method I confess requires much Caution, but if duly Considered, it will be easily understood, and put in practice by the Ingenious observer. SECT.

SECTION VII.

As the beginning, Digits obscured, and end of a Solar Eclipse; So also the Occultation of any Fixed Star by the Moon, its Emersion from her, or the distance of her Center from it when not covered by her, at the time of their Elliptical Conjunction, may be determined by Construction; only, remembring what I have before intimated, that by reason both the Parallaxes and Semidiameters of the fixed Stars are small and almost insensible, the Moons Horizontal Parallax shall be the Semidiameter of the Disk; and her Semidiameter, the Semidiameter of the Penumbra.

And for the Construction of these as of Solar Eclipses will be required.

1. The true time of the Ecliptical Conjunction of the Moon and Star.
2. The Angle of the Moons way with the Ecliptick, or which the Axis of her Orbit formes with the Axis of the Ecliptick.
3. The difference of the true Latitudes of the Moons Center, and the Star to which she applys at the time of the Ecliptical Conjunction.
4. The Stars Right Ascension and distance from the Pole of the Globe.
5. The Inclination of the Axis of the Earths Globe, to the Axis of the Ecliptick in the Disk.

1. To find the first in any given Year and Month; make the Mean Motions of the Moon to that Year and Month, by the help of the Table of the Moons mean Motions, which subtract from the true Longitude of the Star at the given Time, from the Residue subtract the next lesser middle Motion under the Month of *January* in the Eighth Table; and from what remains, the next lesser middle Motions found in the Ninth Table continually till nothing be left; the Days, Hours, Minutes and Seconds standing against the middle Motions, so subtracted, shall be the true time of the Mean Conjunction of the Moon and Star.

2. To this Time calculate the Moons true place in the Ecliptick by the Directions of the Third Section, which if it happen to be the same with the Stars, the time of the Mean and True Conjunction are the same, but if, as commonly, they differ; then,

Note the difference, and if the Moons true place be found short of the Stars, add; if past, subtract about twice as many Hours and Minutes, to or from the time of the Mean Conjunction, as she is Degrees and Minutes short or past the Star; and to the time thus made Calculate her true Longitude in the Ecliptick, betwixt which, and the Stars true place note the Difference:

Then you may say,

As the differences of the places of the Moon Calculated to these two times,
To the difference of the said times;
So the difference betwixt the place of the Moon and the Star last Calculated;
To the interval of time betwixt the last Calculation, and the time of the true Conjunction.

If

If the Moons place found by the last Calculation were less than the Stars, add the interval to; if more, subtract it from the Time to which the last Calculation was made; that Sum or Difference shall be the true equal Time of the Conjunction of the Moon and Star; which by the Equation of Days may be Converted into the Apparent.

But this Method being tedious, I have most commonly made use of another, which besides that it is more Expeditious, will be found to have some other Conveniencies in it above the preceding.

The Moons true places Calculated either from *Tycho's*, or *Kepler's* Numbers I find to agree much better with my own, than any other; From these the places of the Moon are given in *Eichstadius* or *Heckers Ephemerides* for years past; in *Argolus's* for years to come till 1700.

Entring therefore the Ephemerides of that Month in which you desire to know at what time the Moon will be in Conjunction with any Star, you will readily see on what Day her places at Noon will be next less and more than the Stars, the difference betwixt those two places at Noon are her Diurnal Motion. Subtract her place at Noon next less than the Stars, from its true place, so have you their difference:

Say Then,

As the Diurnal Motion, to this difference,
So are 24 hours or one day;
To the time of the Conjunction of the Moon and Star, Afternoon, under the Meridian of the Ephemerides.

The Meridian of *Rome*, to which *Argolus* his Ephemerides are fitted, lies 1 hour nearly to the East of *London*; therefore from the time thus obteined subtract one hour, so have you the time of the Conjunction of the Moon and Star under the Meridian of *London*.

To which if you Calculate the Moons true place by the Tables herewith published, as also to 2 hours either before, or after, as you judge most Convenient, you will have the Moons Motion in 2 hours given, by which and the difference of hers and the Stars true Longitudes at either of the times, you may find the true time of their Conjunction. To get her Latitude at which time,

In the Calculation of the Moons place you will have given the Inclination of her Orbit to the Ecliptick, with the true place of her Node.

Subtract the place of the Node from the Longitude of the Star, the Residue is the Argument of Latitude:

Say Then,

As the Radius,
To the Tangent of Inclination of her Orbit;
So the Sine of the Argument of Latitude,
To the Tangent of the Moons true Latitude at the time of the true Conjunction.

Which

Which if the Argument of Latitude be less than 6 Signes is North, if more South.

And if the Moons Latitude at the time of the true Conjunction be more to the North, or less to the South than the Stars, the Moons Center in her transit by the Star passeth as much to the North of it, as is their difference, but if otherways, as much to the South:

Again,

As the Radius,
To the Sine of the Inclination of the Orbit;
So the Co-sine of the Argument of Latitude,
To the sine of the Angle of the Moons way with the Ecliptick.

Or which the Axis of her Orbit formes with the Ecliptick, from which it lies to the Right-hand, when the Argument of Latitude is more than 9 Signes, or under 3; but to the left when the said Argument is more than 3 Signes, or less than 9.

The Longitudes of the Stars from the first Point of ♈ with its Latitude being given, its distance from the Pole and Right Ascension may be got by the Directions of the 14 Section of the First Part, or more easily, and exact enough for our purpose, by the Tables of Declination and Right Ascension Printed herewith, from the beginning to page 37, which being obteined it will hold.

As the Co-sine of the Stars Latitude,
To the Co-sine of its Right Ascension from the next Equinoctial Point;
So the sine of the distance of the Poles of the Globe and Ecliptick,
To the sine of the Inclination of the Earths Axis to the Ecliptick.

Which if the Longitude of the Star be in ♑ ♒ ♓ ♈ ♉ ♊ is to the Left, if in any of the other 6 Signes to the Right-hand from the Axis of the Ecliptick.

As in the Construction of the Solar Eclipse, the Plane upon which the Projection was drawn was supposed to stand at Right-angles to the Line Connecting the Centers of the Sun and Earth, coincident with the Moons Orbit; so in the Stellar Eclipse we must suppose it to coincede with the Moons way at Right-angles to the Line Connecting the Centers of the Earth and Star, and that Lines produced from the Star to Infinite Points in the Horizon of the Earths Disk, her Axis, the Axis of the Ecliptick, and the Path of any Vertex, will project them all in the same Plane.

Having shewn before how this projection may be represented and delineated in *Plano*, I shall not need here to repeat any directions concerning it, but seeing the Path of the Vertex, and Line of the Moons way over the Disk may be divided several ways; I shall only teach one, which in my opinion seems the most convenient for our purpose.

When

When the Vertex passeth the Axis of the Globe projected in the Disk, the Star Transits the Meridian; I call *that time the Sidereal Noon*, and mark the intersection with *o*; the hours on each side it projected in the Path I number by their distances from it: 1, 2, 3, 4, 5, 6, *&c.* as in the Twelfth Figure, those on the Right-hand being *Negative*, and shewing the Star short of the Meridian; those on the Left *Affirmative*, and shewing it past.

Having got the Apparent time of the true Ecliptical Conjunction, turn it into Degrees and Minutes; get the Suns Right Ascension at the same time. Add these together, the Sum shall be the Right Ascension of the Midheaven, which if it be less than the Stars Right Ascension subtracted from it, leaves an Arch, which turn'd into time gives *the time before the Sidereal Noon, at which the Moons Center shall Transit the Axis of the Ecliptick.*

But if the Right Ascension of the Midheaven be greater than the Stars, subtract this from that, the Residue converted into time, will give *the Sidereal hour Afternoon of the said Transit.*

Diminish the Moons true horary Motion by the 365th part of it self, the Residue is the *Sidereal horary Motion of the Moon:*

Say Then,

As 1 *Hour or* 60 *Minutes,*
To the Sidereal horary Motion;
So the Minutes and Seconds above any hour, at which the Ecliptical Conjunction happens,
To the Motion answering it.

Take this Motion betwixt your Compasses from the Scale of Minutes or equal parts, and setting one Foot on that Point where the Line of the Moons way intersects the Axis of the Ecliptick, with the other make a Point on the said Line; if the time of the Conjunction were before the Sidereal Noon, on the Left-hand; if after it, on the Right; this shall be the place of the Moons Center at the said hour.

Take the Moons Sidereal horary Motion betwixt your Compasses from the said Scale of Minutes, and setting one Foot on the Point last made, transfer the distance in the said Line to and fro, making as many more Points at the said Distance from each other as you shall find convenient, these shall be the places of the Moons Center at other hours: Divide each hour space into 60 equal parts, so have you the place of the Moons Center to every Minute of the Sidereal hour, which if the time of the Ecliptical Conjunction were before the Sidereal Noon, are to be Numbred successively from the Left-hand to the Right, as in the Twelfth Figure; but if after it, the contrary way, or from the Right-hand to the Left.

Taking the Semidiameter of the Moon betwixt your Compasses from the Scale of Minutes, carry one Point along the Line of the Moons way, till the other turn'd about will first cut the same time in the Path of the Vertex,

Vertex, if before the Sidereal Noon in the hours on the Right-hand the Axis of the Globe, if after it, on the Left; the Point on which the fixed Foot then stands, shall be the place of the Moons Center, and shall shew the Sidereal hour from Noon at which the Star shall be covered by the Moon.

In like manner carrying the Foot of the Compasses, forward or from the Right-hand to the Left, find another Point in the said Line, on which one Foot of the Compasses being set, the other turn'd about will cut the same hour in the Path of the Vertex, this shall be the place of the Moons Center and Sidereal hour from Noon at which she shall uncover the Star, or of its Emersion from her.

Subtract the Suns Right Ascension from the Stars, the remainer turn'd into time, shall give the time of *the Stars Culmination*, or when it Transits the Meridian.

If the Sidereal hour of the Stars Occultation or Emersion were before the Sidereal Noon, subtract it from the time of the Stars Culmination; if it were after, add them together, so have you the true times of the Stars Occultation and Emersion.

But if the time of the visible Conjunction of the Moons Center and the Star, or some other, which she shall not cover, be required, find a Point in the Line of the Moons way, whence a Line drawn Parallel to the Axis of the Ecliptick, shall cut the same hour in the Path of the Vertex that it touches in the Line of her way, this shall be the Sidereal hour of the visible Conjunction; whence the Solar may be derived as before directed.

Take the Moons Semidiameter betwixt your Compasses from the Scale of Minutes, and setting one Foot on the Point so found in the Line of her way, with the other describe a Circle, this shall represent her Disk, and the distance of the nearest part of it from the Vertex at that time measured on the Scale of equal Parts or Minutes, will shew how many Minutes the Moons next Limb will be distant from the Star at the time of the visible Conjunction.

The following Example will make these directions easily understood.

If it be required to know at what time the Moon will be in Conjunction with *Aldebaran*, or the Southern Eye of the Bull, in *December* this instant Year, 1680.

The place of the Star will be then ♊ 5° 19′ 20″, its Latitude South 5° 30′$\frac{1}{6}$; And by the Ephemerides the Moon will be in the same Longitude on the 22 of *December*, at 6^h 30′ Afternoon at *London.*

	°	′	″
The Moons true place then by my Tables ♊ . . .	05	09	32
but at 2 hours after, or at 8^h 30′ in ♊ . . .	06	24	28
Therefore the Moons true Motion in 2 hours . . .	01	14	56
and her true horary Motion	00	37	28
Moons place at 6 Hours 30 Minutes in Antecedence of the Star	00	09	48

Therefore the Apparent Time of the Ecliptical Conjunction at *London*, $6^h\ 45'\ 42''$ Afternoon.

	s	°	'	"
The Inclination of the Moons Orbit then . .	00	05	01	49
The true place of the Node	05	23	44	00
The Argument of Latitude	08	11	25	20

Therefore,

The Inclination of the Axis of the Moons Orbit to the Axis of the Ecliptick on the left hand *z e*.	01	36	00
Fig. 12. The Moons Latitude South	04	46	03
Less than the Stars . . . . ✳ N	00	44	07

	°	'	"	
The Inclination of the Axis of the Ecliptick to the Axis of the Globe on the left hand, *e i*, ...	09	57	30	
The Stars distance from the North Pole of the Globe	74	11	30	
Difference of it and the Complement of the Latitude	35	39	00	*o s*
Sum of it and the said Comp. 112° 4', Comp. to 180°	67	16	30	*m s*

Time of the ☌ $6^h\ 45'\ 42''$, converted into deg. and min. makes	101	25	30
Sun then in ♑ 12° 10' $\frac{1}{3}$; his Right Ascension	283	15	00
The Right Ascension of the Midheaven, Subtract . . .	24	40	30
The Right Ascension of *Aldebaran*	64	24	30
The Sidereal hour of the Conjunction, before the Sidereal Noon Or in time $2^h\ 38'\ 56''$.	39	44	00

The Right Ascension of the Sun 283° 15' Subtracted from the Right Ascension of the Star 64° 24' $\frac{1}{2}$, leaves 141° 09' $\frac{1}{2}$, which converted into Time gives $9^h\ 44'\ 38''$, the time of its Culmination or Southing.

	'	"
The Moons Sidereal horary Motion	37	19
Her Motion in 38' 56" of Time	24	13

To be laid off in the Line of the Moons way from its intersection with the Axis of the Ecliptick to the left hand.

In

In the Twelfth Figure, having drawn the Semicircle *r e* H, let it represent one half of the Earths Disk, *e* ✳ the Axis of the Ecliptick; from *e* set off *e z* on the Left-hand = 1° 36', and *e i* 9° 57' $\frac{1}{2}$: draw the Line ✳ *z*, it shall represent the Axis of the Moons Orbit in the Disk, and ✳ *i* the Axis of the Globe.

If making ✳ *i* the Radius of a Line of Sines, you take the Sine of 35° 39', and set it off in the Axis of the Globe from ✳ to *o*, and the Sine of 67° 16' $\frac{1}{2}$ from ✳ to *m*, the middle betwixt these Points C will be the Center of the Ellipsis representing the Path, and C *o* = C *m* its Conjugate Semidiameter.

Through C strike a Line at Right-angles to the Axis of the Globe, and therein set off the Sine of 38° 32' the Complement of the Latitude, from C both ways; this shall be the Conjugate Semidiameter of the Ellipsis representing the said Path of the *Observatory*, which may now be described, and the hour Points laid down in it, as in the Projection for the Eclipse, but the hours numbred as was last directed.

The Moons Horizontal Parallax will be 61' 31", her Horizontal Semidiameter 16' 41": Make a Scale of such equal parts, as that ✳ *i* the Radius of the Disk may be 61 $\frac{31}{60}$, (such a one I have drawn under the Twelfth Figure) take there from 44 $\frac{07}{60}$, the Moons Latitude from the Star to the North, and set it off in the Axis of the Ecliptick from ✳ to N, through which Point draw the Line 4 N 1 at Right-angles to ✳ *z*, this shall be the Line of the Moons way.

The Moon passeth the Axis of the Ecliptick, or will be in Conjunction with the Star 38' 56" more than 2 hours before the Star will pass the Meridian; the Moons Sidereal Motion in that time is 24' $\frac{13}{60}$; taking therefore 24' $\frac{13}{60}$ from the Scale of Minutes betwixt your Compasses, and setting one Foot on N the intersection of the Moons way, and the Axis of the Ecliptick, transfer the said distance in the Line of the Moons way, (because the Conjunction happens before the Culmination of the Star) on the Left-hand, it shall give the place of the Moons Center 2 hours before the Sidereal Noon, or the Culmination of the Star.

From the same Scale of Minutes taking 37 $\frac{19}{60}$ the Moons Sidereal horary Motion, and setting one Foot of the Compasses on 2, with the other make Points in the said Line, and carrying the said Extent from 3 on the Right-hand, it gives the Point 4; so have we got the Place of the Moons Center at 4, 3, 2, and 1 hours before the Star Transits the Meridian.

Dividing the spaces betwixt each of these into 60 equal parts, as in the Figure, we have the place of the Moons Center to every single Sidereal Minute of the Intermediate Time.

Taking the Moons Semidiameter betwixt your Compasses, and carrying one Foot along the Line of the Moons way thus divided; when it comes to *α* at $3^h\ 44'\frac{1}{2}$, the other Foot turn'd about will cut the same time in the Path of the Vertex; this therefore is the time before the Culmination of the Star, at which it will be covered by the Moons preceding Limb; and carrying the said Foot unto *β* at $2^h\ 40'\frac{1}{4}$ the other turn'd about again cuts the same

K 2 hour

hour in the Path of the Vertex, and therefore the Emersion of the Star will be $2^h\ 40'\frac{1}{2}$ before it cross the Meridian.

If now from $9^h\ 44'\frac{3}{4}$ the time of the Stars Culmination, we subtract $3^h\ 44'\frac{3}{4}$ the Residue 6^h will be the time of the Stars Occultation; and if from the said time of Culmination we take away $2^h\ 40'\frac{1}{4}$, it leaves $7^h\ 04'\frac{1}{2}$ the true time of the Stars Emersion from the Moon.

To γ, the place of the Vertex at the time of the Stars Occultation, let ✱γ be drawn, and through the Moons Center εα Parallel to it; εγ shall be the distance of the Star from the lowest Point of the Moons Periphery at the time of its Occultation, equal to εγ in the Thirteenth Figure; and if in like manner we draw ✱δ from the Center of the Projection to the place of the Vertex at the Stars Emersion from the Moon, and through her Center ζβ Parallel to it, then will ζδ be the distance of the Star from the lowest Point of the Moons Periphery at its Emersion, equal to εδ in the Thirteenth Figure, in which these Appearances are represented in respect of the Vertical ηε passing by the Moons Center.

If the Times of the Occultation and Emersion were required at some other place, whose Latitude and Difference of Meridians from *London* are known: First the Path of the Vertex must be drawn, then the hours numbred in the Line of the Moons way, if the place lie to the East of *London* must be accounted so much less if the Star be short of the Meridian, so much more if past it, as the difference of Meridians really is: But if the place lie to the West of *London*, then so much more whilst the Star is short of the Meridian, so much less when past, as is the said difference of Meridians.

And the time of the Occultation and Emersion of the Star, will be easily found by the Method before prescribed and employ'd.

Or the Difference of Meridians betwixt any two places whose Latitudes are known, may be investigated by the observed Occultation or Emersion of the Star from the Moons Limb, or its distances and Positions from her at both places, the times being carefully noted, by the Method suggested before in the description of the Solar Eclipse, nor is it necessary that the observed times of the same Appearance at both places should be known; For if the time of the Stars Occultation or Emersion at one place were accurately observed, at the other a distance and Position of the Star, the difference of Meridians may thence be determin'd as easily as if the Occultation and Emersion were observed at both places, by the Method suggested in the description of the Solar Eclipse.

And had we such Lunar Numbers as would shew us the Moons true place to half a Minute, or the 120th. part of a Degree, we needed not doubt but that by this Method the Difference of Meridians betwixt the place to which the said Numbers should be fitted, and any other, where some Appearance of an *Appulse of the Moon* to any known fixed Star should be observed, might be readily obteined by one onely accurate observation; For the places of the fixed Stars I have hopes may be rectified to that exactness; The Work, by His *MAJESTIES Princely Care for the Improvement of NAVIGATION*, being somewhile since begun and carried on as far as the *Time* and *the Observers Accommodations* would permit; Nor is it to be feared, but that the Motions of the Moon may be rectified to as great exactness by the means of those many Lunar Observations, which have been frequently made at the *Observatory* by the same Person, and by others elsewhere, to far greater exactness than could formerly be hoped for, and that without omitting any opportunity when the season permitted, except when the Observers have been prevented by infirmities or indispensable occasions.

I have Numbred above 200 Fixed Stars in *Tycho*'s Catalogue that lie in the Moons way, and may all of them be Eclipsed by her in one Revolution of her Node; *The* Greenwich *Observations* make above 300: There can scarce happen 2 Nights together, but some or other of them will be Eclipsed in one place or other of the Earth. These Appulses seem therefore one of the best expedients that can be propounded for the discovery of the *LONGITUDE*, and surely since we have found and Taught so easy a way to Construct them, and that too perfectly *Geometrical*, those who are so urgent upon the *Astronomer* for a good Method to find it, will not think much to be at the pains to Learn and Understand this, seeing it may be practis'd by one Observer if accommodated with convenient Instruments; And I hope also that those Ingenious Persons who have imploy'd their pains and Studies to correct the *Old*, or find a *better Theory of the Moons Motions*, will be hereby encouraged to prosecute their useful Endeavours, considering both the facillity of this Method, the Benefit is thence like to accrue to *Mankind*, and the *Reputation and Credit to themselves and their Memories.*

SECTION VIII.

HAving shewn in the preceding *Sections* how to find the places on the Earth, and Times there, where any of the principal Phases of a Solar Eclipse shall appear, by Calculation; as also how the Times of any Appearance of a Solar Eclipse or Stellar may be determin'd in any given Latitude and Longitude by Construction; It remains now, that I shew how the Times of the Principal Appearances and quantity of any Lunar Eclipse may also be found.

In the Fourth *Section* of this part I have taught how to find the Mean Time of the Mean opposition of the Luminaries, the Apparent Time of the True, their places then, and hourly Motions, their Horizontal Parallaxes and Semidiameters, with the nearest distance of the Moons Center from the Center of the Disk, and shadow, in her passage over either; I shall not need here therefore to repeat the directions how to find them; admit them known, and then,

Add the Moons Horizontal Parallax and the Suns (which I suppose always 10") together, from which Sum subtract the Suns Semidiameter, the remainer shall be the Semidiameter of the Earths shadow.

Add

Add the Moons Semidiameter to the Semidiameter of the ſhadow, if the Sum be greater than the neareſt diſtance of the Moons Center from the Center of the ſhadow at the time of the oppoſition in the Orbit, ſhe will be really Eclipſed, otherways not.

Subtract the Moon's Semidiameter from the Semidiameter of the ſhadow, ſo have you their difference, which if it be greater than the ſaid neareſt diſtance of the Moons Center from the ſhadows, the Eclipſe will be Total, otherways only partial.

From the Sum of the Semidiameters of the Moon and ſhadow ſubtract the neareſt diſtance of their Centers, the Reſidue is the parts deficient:

Say Then,

As the Moons Semidiameter,
To 6 Digits;
So are the parts deficient,
To the Digits Eclipſed.

Again,

As the Sum of the Semidiameters of the Moon and ſhadow,
To the Radius;
So the neareſt diſtance of the Centers of the ☽ *and ſhadow at the* ☍ *in the Orbit,*
To the Co-ſine of the Angle of Incidence.

And in Total Eclipſes,

As the difference of the Semidiameters of the Moon and ſhadow,
To the Radius;
So the ſaid neareſt diſtance of their Centers,
To the Co-ſine of the Angle of Immerſion, or Emerſion.

For the Motion of Semiduration,

As the Radius,
To the Sine of the Angle of Incidence;
So the Sum of the Semidiameters of the Moon and ſhadow,
To the ſaid Motion of Semiduration.

And in Total Eclipſes,

As the Radius,
To the Sine of the Angle of Immerſion;
So the difference of the Semidiameters of the Moon and ſhadow,
To the Motion of Semimora, or half Continuance of the Total Darkneſs.

To convert which Motions into Time, ſay again,

As the hourly Motion of the Moon from the Earth,
To one hour, or 60 Minutes;
So the Motion of Semiduration,
To half the time of the whole continuance of the Eclipſe.

And,

So the Motion of Semimora,
To half the time of the continuance of Total Darkneſs.

The half time of whole continuance ſubtracted from and added to the Apparent time of the middle of the Eclipſe, gives the true time of its Beginning and End, and in like manner,

Half the time of the continuance in Total Darkneſs ſubtracted from and added to the Time of the middle gives the true Times of the Immerſion and Emerſion, or beginning and end of Total Darkneſs.

To illuſtrate theſe precepts by an Example, I ſhall give the heads of the Calculus of a partial Lunar Eclipſe, which will happen in *Auguſt*, 1681.

The Mean time of the Mean oppoſition is on the 18th. Day *Old-Stile*, at $9^h\ 47'\ 37''$ p. m.

	s	°	'	"
The Earths Mean Anomaly then	02	00	48	41
The Suns true place	♍	06	01	30
The Annual Argument	08	06	09	30
The Moons Mean Anomaly	01	28	02	40
Her true place in her Orbit	♓	03	19	36
Short of the oppoſition	00	02	41	54
The Earths true hourly Motion 2′ 25″, Moons			31	56
Hourly Motion of the Moon from the Earth			29	31

	h	'	"
The Interval of the Mean and true ☍ add	05	29	06
The equal time of the true ☍ *Aug.* 18th. at	15	16	44 *p. m.*

At which Time,

	s	°	′	″
The Mean Anomaly of the Earth is	02	01	02	12
The Suns true place	♍	06	14	48
The Annual Argument	08	06	21	16
The Moons Mean Anomaly	11	10	51	26
Her true place in her Orbit	♓	06	14	48
Her true hourly Motion 32′ 01″, from the Earth	00	00	29	36
Argument of Latitude	05	24	13	04

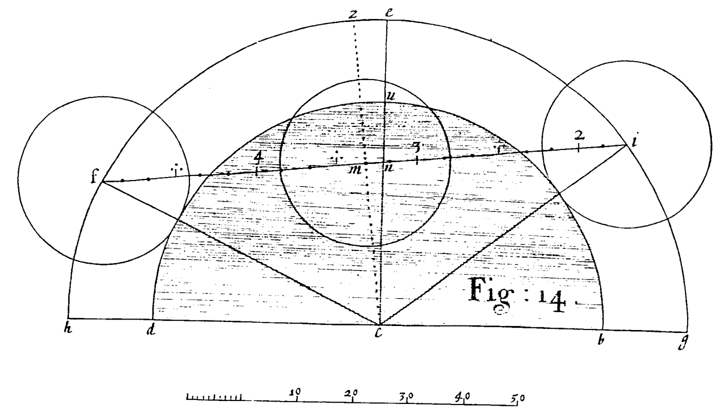
	h	′	″
Time of Reduction	00	03	04
Mean Time of the ☊ in the Ecliptick	15	13	40
Mean time of the middle of Eclipse	15	19	48
Equation of Days subtract from the Mean time	00	00	28
Apparent time of the middle of the Eclipse	15	19	20

	°	′	″
Moons Horizontal Parallax	00	56	47
Suns Semidiameter subtracted	00	15	58
Semidiameter of the shadow	00	40	49
Moons Semidiameter	00	15	25
Their Sum	00	56	14
The Moons Latitude North subtract	00	30	12
The parts deficient	00	26	02
Digits Eclipsed 10 Digits 8′.			
Angle of Incidence	57	31	00
Motion of Semiduration	00	47	26

	h	′	″
Time of Semiduration	01	36	09

There-

An Eclipse of the Moone
1681 August the 19th in the Morneing.



A Scale of Minutes.

between page 72 and 73. the Doctrine of the Sphere.

Therefore,

	h	′	″	
The beginning of the Eclipse at	1	43	11	After the Midnight following the Eighteenth of *August*, or the 19th. Day in the Morning.
Ecliptical ☍ of the ☉ and ☽ . .	3	13	12	
Middle or greatest Obscuration .	3	19	20	
End	4	55	26	
Total duration	3	12	18	

The Times of any Appearance of a Lunar Eclipse may be found by Construction, as the Times of the general Phases of the Solar were before, and the directions given for the Protraction of that will likewise serve for the Delineation of this. For Example, if it were required to represent *in Plano* the Lunar Eclipse, of which I have now found the Times of the principal Phases by Calculation; Having made a Scale of Minutes or equal parts for your purpose, take thence the Sum of the Semidiameters of the Moon and shadow $56\frac{14}{60}$, and drawing first a streight Line *hcg*, which may represent an Arch of the Ecliptick, upon Paper; chuse therein a Center *c*, and setting one Foot of the Compasses thereon, with the other describe a Semicircle *hzeg* (if the Moon have North Latitude) above, if South, beneath the Line; but if her Latitude be not more than 5 Minutes, an entire Circle; in the Periphery of this the Moons Center shall be found at the Beginning and End of the Eclipse.

Taking from the same Scale the Semidiameter of the shadow $40\frac{42}{60}$ betwixt your Compasses, set one Foot on the Center *c*, and with the other describe the Semicircle *dub*, this shall represent half the shadow.

From *c* raise the Line *ce* Perpendicular to the Ecliptick *dg*, and then making *ce* the Radius of a Line of Chords, take the Chord of 05° 41′ (the Angle which the Perpendicular to the Moons way makes with the Ecliptick) and setting it off from *e* to *z*, draw the Line *zc*, this shall be the said Perpendicular.

From the Scale of Minutes take $30'\frac{12}{60}$ betwixt your Compasses, and transfer them in the Line *cz*, from *c* to *m*, through *m* draw the Line *imf* at Right-angles to *zc*, this shall be the Line of the Moons way, and the Points *i*, *m*, and *f*, the places of her Center at the Beginning, Middle, and End of the Eclipse.

From the Center *c* draw the Lines *ci* and *cf*, the Angle $mci = mcf$ formed hereby shall be the Angle of Incidence.

The middle of the Eclipse happens 19′ 20″ after 3 in the Morning, the Moons horary Motion from the Earth is 29′ 36″; therefore in 19′ 20″, her Motion from the Earth 09′ 32″; take therefore 09′ $\frac{32}{60}$ from the Scale of Minutes betwixt your Compasses, and setting one Foot on *m*, with the other make a mark on the Line of the Moons way on the Left-hand, this shall be the place of the Moons Center at 3 hours after Midnight, or in the Morning.

Taking from the same Scale 29 $\frac{36}{60}$ the Moons hourly Motion from the Earth, set it off in the said Line from 3 on both sides, it gives you the Points 2 and 4, or the place of the Moons Center at 2 and 4 a Clock in the Morning.

And if the spaces betwixt these be divided into 60 parts, and the Residue of the Line till it touch the utmost Circle, in the same manner, the Minutes there cut shall shew the Beginning and End of the Eclipse.

In the Figure I have divided the Line of the Moons way onely to every 10 Minutes, it being sufficient for the Explication of the Method; which I esteem far more troublesome than a Calculation, and therefore should rather perswade the use of the Pen, than the Compasses to determin the Appearances of Lunar Eclipses.

In the Calculation of which, as also of the Principal Phases of the Solar, I must acquaint my *Reader*, that tho I have employ'd the Line of the Moons way, and that which connects her Center with the Center of the Disk, or shadow, at their nearest distance, as if they were perfect streight Lines, yet are they really small Arches of great Circles, whose Curvities are so little, that their difference from streight Lines is imperceptible, and the Error, that is caused by my using them as such, altogether inconsiderable.

The difference of Meridians betwixt any two places on the Earths Globe, may be readily obtained by the observation of the same Appearance of a Lunar Eclipse, or the Occultation or Emersion of the same Spot from the Earths shadow accurately noted at both places, for the difference of the observed Times shall be the difference of Meridians betwixt those two places *in Time*, of which that shall be to the East from the other, where the Noted time is the most from Noon: For Example in the Year 1678, *October* the 19th. *Old-Stile*, the end of a Lunar Eclipse was accurately Noted at His *MAJESTIES Observatory* at *Greenwich* at 10^h 10′ 38″ Afternoon; but at *Paris* at 10^h 20′; wherefore the difference of Meridians betwixt the *Observatories* of *Greenwich* and *Paris* by this Observation should be 9′ 22″ of Time: We observed likewise in the same Eclipse that the *Spot* called *Byzantium* by *Hevelius* was first covered by the shadow of *Greenwich* at 7^h 09′ 14″, but at *Paris* its Occultation was Noted at 7^h 18′ 28″, whence the difference is found onely 9′ 14″, or 2° 16′; and so much we have determin'd the difference of Meridians betwixt the *Observatories* of *Paris* and *Greenwich*, by comparing 22 several Appearances carefully observed in the same Eclipse at both places.

As by Lunar Eclipses, so also by the Eclipses of *Jupiters* Satellits, the difference of the observed Moments of the Occultation or Emersion of a Satellit from his shadow noted carefully in two distant places will be the difference of Meridians betwixt those two places in Time; But I cannot hope that this Method shall prove of much use to the Ingenuous *Sea-man*, because the Observations require long Telescopes which in a Ship will hardly be manageable. Nor can we expect to find the difference of Meridians by one only Observation of a Satellit Eclipse, as we have hopes we may by a Lunar, by reason that as yet the inequalities in their Motions, and the time required for the Transmission of Light from the Planet to our Earth are unknown; Nay their Mean Motions are scarce so exactly stated, but that we may justly suspect them erroneous; Ommitting these therefore, the best Method for the discovery of the *Longitude* will be in my opinion by the Moons *Appulses* to, or *observed distances* from fixed Stars, upon which account I would recommend the Improvement and Correction of her *Theory*, with the *Doctrine* and *Construction of Appulses*, to the Study of the Ingenuous Astronomer and Sea-men.

ASTRONOMICAL

TABLES

For finding the true places of

LUMINARIES,

AND THEIR

ECLIPSES,

AT ALL TIMES.

J. Mathesin à Sole Fundes.

TABLE

I. II.

The Equations of the Apparent Time.

I. Subtract from the Apparent, if the Suns Mean Anomaly be,

Sign.	0 (′ ″)	1 (′ ″)	2 (′ ″)	3 (′ ″)	4 (′ ″)	5 (′ ″)	
0	0 00	3 46	6 34	7 40	6 42	3 54	30
1	0 08	3 53	6 38	7 40	6 38	3 47	29
2	0 16	3 59	6 42	7 40	6 34	3 40	28
3	0 23	4 06	6 46	7 40	6 29	3 33	27
4	0 31	4 13	6 49	7 39	6 26	3 25	26
5	0 39	4 19	6 53	7 39	6 21	3 18	25
6	0 47	4 26	6 57	7 38	6 17	3 11	24
7	0 55	4 32	7 00	7 38	6 12	3 03	23
8	1 03	4 38	7 03	7 37	6 07	2 56	22
9	1 10	4 45	7 06	7 36	6 02	2 48	21
10	1 18	4 51	7 09	7 34	5 57	2 40	20
11	1 26	4 57	7 12	7 33	5 52	2 33	19
12	1 34	5 03	7 14	7 32	5 46	2 25	18
13	1 41	5 09	7 17	7 30	5 41	2 17	17
14	1 49	5 15	7 19	7 28	5 36	2 09	16
15	1 57	5 20	7 22	7 26	5 30	2 01	15
16	2 04	5 26	7 24	7 24	5 24	1 53	14
17	2 12	5 32	7 26	7 22	5 18	1 45	13
18	2 19	5 37	7 28	7 20	5 12	1 37	12
19	2 27	5 42	7 30	7 18	5 06	1 29	11
20	2 34	5 48	7 31	7 15	5 00	1 21	10
21	2 42	5 53	7 33	7 12	4 54	1 13	9
22	2 49	5 58	7 34	7 10	4 48	1 05	8
23	2 56	6 03	7 35	7 07	4 41	0 57	7
24	3 03	6 07	7 36	7 04	4 35	0 49	6
25	3 11	6 12	7 37	7 00	4 28	0 41	5
26	3 18	6 17	7 38	6 57	4 22	0 33	4
27	3 25	6 21	7 39	6 54	4 15	0 24	3
21	3 32	6 26	7 40	6 50	4 08	0 16	2
29	3 39	6 30	7 40	6 46	4 01	0 08	1
30	3 46	6 34	7 40	6 42	3 54	0 00	0
	11	10	9	8	7	6	

Add to the Apparent Time.

II. Subtra. from the Apparent.

	♈ ♎ (′ ″)	♉ ♏ (′ ″)	♊ ♐ (′ ″)	
0	0 00	8 24	8 46	30
1	0 20	8 35	8 36	29
2	0 40	8 45	8 25	28
3	1 00	8 54	8 14	27
4	1 19	9 03	8 01	26
5	1 39	9 11	7 49	25
6	1 59	9 18	7 35	24
7	2 18	9 25	7 21	23
8	2 37	9 31	7 06	22
9	2 57	9 36	6 51	21
10	3 16	9 41	6 35	20
11	3 34	9 45	6 19	19
12	3 53	9 49	6 02	18
13	4 11	9 51	5 45	17
14	4 29	9 53	5 27	16
15	4 47	9 55	5 09	15
16	5 04	9 55	4 50	14
17	5 21	9 55	4 31	13
18	5 38	9 54	4 12	12
19	5 54	9 52	3 52	11
20	6 10	9 50	3 32	10
21	6 26	9 47	3 12	9
22	6 41	9 43	2 51	8
23	6 55	9 38	2 30	7
24	7 10	9 33	2 09	6
25	7 23	9 27	1 48	5
26	7 36	9 20	1 27	4
27	7 49	9 13	1 05	3
28	8 01	9 05	0 43	2
29	8 13	8 56	0 22	1
30	8 24	8 46	0 00	0
	♓ ♍	♒ ♌	♑ ♋	

Add to the Appa.

TABLE III.

A Table of the Earths Mean Motions, the place of her Perihelion, and the recess of the Equinoxes from the first * of ♈.

Years of Christ current.	Mean Motion of the Earth from the Equinox. s ° ′ ″	The ☉ Periheli. from the vernal Equinox. s ° ′ ″
1	9 07 55 51	2 13 31 40
1501	9 19 13 29	3 04 21 40
1581	9 19 49 38	3 05 28 20
1601	9 19 58 40	3 05 45 00
1621	9 20 07 42	3 06 01 40
1641	9 20 16 44	3 06 18 20
1661	9 20 25 46	3 06 35 00
1681	9 20 34 48	3 06 51 40
82	9 20 20 28	3 06 52 30
83	9 20 06 08	3 06 53 20
84	9 19 51 48	3 06 54 10
85	9 20 36 36	3 06 55 00
86	9 20 22 16	3 06 55 50
87	9 20 07 56	3 06 56 40
88	9 19 53 36	3 06 57 30
89	9 20 38 25	3 06 58 20
90	9 20 24 05	3 06 59 10
91	9 20 09 45	3 07 00 00
92	9 19 55 25	3 07 00 50
93	9 20 39 13	3 07 01 40
94	9 20 25 53	3 07 02 30
95	9 20 11 33	3 07 03 20
96	9 19 57 13	3 07 04 10
97	9 20 42 02	3 07 05 00
98	9 20 27 42	3 07 05 50
99	9 20 13 22	3 07 06 40
1700	9 19 59 0[illegible]	3 07 07 30
1701	9 20 43 5[illegible]	3 07 08 20
1721	9 20 52 5[illegible]	3 07 25 0[illegible]
1741	9 21 01 54	3 07 41 40
1761	9 21 10 56	3 07 58 20
1781	9 21 19 58	3 08 15 00
1801	9 21 29 01	3 08 31 40

Common Years.	Mean Motion for Compleat Years. s ° ′ ″	The Perihelion and fixt Stars. s ° ′ ″
1	11 29 45 40	0 00 00 50
2	11 29 31 20	0 00 01 40
3	11 29 17 00	0 00 02 30
4	00 00 01 48	0 00 03 20
5	11 29 47 28	0 00 04 10
6	11 29 33 08	0 00 05 00
7	11 29 18 48	0 00 05 50
8	00 00 03 36	0 00 06 40
9	11 29 49 16	0 00 07 30
10	11 29 34 56	0 00 08 20
11	11 29 20 36	0 00 09 10
12	00 00 05 25	0 00 10 00
13	11 29 51 05	0 00 10 50
14	11 29 36 45	0 00 11 40
15	11 29 22 25	0 00 12 30
16	00 00 07 13	0 00 13 20
17	11 29 52 53	0 00 14 10
18	11 29 38 33	0 00 15 00
19	11 29 24 13	0 00 15 50
20	00 00 09 02	0 00 16 40
40	00 00 18 04	0 00 33 20
60	00 00 27 06	0 00 50 00
80	00 00 36 08	0 01 06 40
100	00 00 45 10	0 01 23 20
200	00 01 30 21	0 02 46 40
300	00 02 15 31	0 04 10 00
400	00 03 00 42	0 05 33 20
500	00 03 45 52	0 06 56 40
600	00 04 31 03	0 08 20 00
700	00 05 16 13	0 09 43 20
800	00 06 01 24	0 11 06 40
900	00 06 46 34	0 12 29 00
1000	00 07 31 45	0 13 53 20
2000	00 15 03 30	0 27 46 40
3000	00 22 35 15	1 11 40 40
4000	01 00 07 01	1 25 33 20
5000	01 07 38 46	1 09 26 40

A Table of the Earths Mean Motions

Days	January. Earths Mean Motion.	M P.	February. Earths Mean Motion.	M P.	March. Earths Mean Motion.	M P.	April. Earths Mean Motion.	M P.
"	s ° ' "	"	s ° ' "	"	s ° ' "	"	s ° ' "	"
1	0 00 59 08	00	1 01 32 27	04	1 29 08 20	08	2 29 41 38	12
2	0 01 58 17	00	1 02 31 25	05	2 00 07 28	08	3 00 40 46	13
3	0 02 57 25	00	1 03 30 43	05	2 01 06 36	08	3 01 39 55	13
4	0 03 56 33	01	1 04 29 52	05	2 02 05 45	09	3 02 39 03	13
5	0 04 55 42	01	1 05 29 00	05	2 03 04 53	09	3 03 38 11	13
6	0 05 54 50	01	1 06 28 08	05	2 04 04 01	09	3 04 37 20	13
7	0 06 53 58	01	1 07 27 16	05	2 05 03 10	09	3 05 36 27	13
8	0 07 53 07	01	1 08 26 25	05	2 06 02 18	09	3 06 35 36	13
9	0 08 52 15	01	1 09 25 33	06	2 07 01 26	09	3 07 34 45	13
10	0 09 51 23	01	1 10 24 41	06	2 08 00 35	09	3 08 33 53	14
11	0 10 50 32	02	1 11 23 50	06	2 08 59 43	10	3 09 33 01	14
12	0 11 49 40	02	1 12 22 58	06	2 09 58 51	10	3 10 32 10	14
13	0 12 48 48	02	1 13 22 06	06	2 10 58 00	10	3 11 31 18	14
14	0 13 47 57	02	1 14 21 15	06	2 11 57 08	10	3 12 30 26	14
15	0 14 47 05	02	1 15 20 23	06	2 12 56 16	10	3 13 29 34	14
16	0 15 46 13	02	1 16 19 31	06	2 13 55 25	0	3 14 28 43	14
17	0 16 45 22	02	1 17 18 40	07	2 14 54 33	10	3 15 27 51	15
18	0 17 44 30	02	1 18 17 48	07	2 15 53 41	11	3 16 27 00	15
19	0 18 43 38	03	1 19 16 56	07	2 16 52 50	11	3 17 26 08	15
20	0 19 42 47	03	1 20 16 04	07	2 17 51 58	11	3 18 25 16	15
21	0 20 41 55	04	1 21 15 13	07	2 18 51 06	11	3 19 24 24	15
22	0 21 41 03	04	1 22 14 21	07	2 19 50 15	11	3 20 23 33	15
23	0 22 40 12	04	1 23 13 30	07	2 20 49 23	11	3 21 22 41	15
24	0 23 39 20	04	1 24 12 38	08	2 21 48 31	11	3 22 21 49	16
25	0 24 38 29	04	1 25 11 46	08	2 22 47 40	11	3 23 20 58	16
26	0 25 37 37	04	1 26 10 55	08	2 23 46 48	12	3 24 20 06	16
27	0 26 36 45	04	1 27 10 03	08	2 24 45 56	12	3 25 19 14	16
28	0 27 35 53	04	1 28 09 11	08	2 25 45 05	12	3 26 18 23	16
29	0 28 35 02	04			2 26 44 13	12	3 27 17 31	16
30	0 29 34 10	04			2 27 43 21	12	3 28 16 39	16
31	1 00 33 18	04			2 28 42 30	12		

to every Day in the Year.

Days	May. Earths Mean Motion.	M P.	June. Earths Mean Motion.	M P.	July. Earths Mean Motion.	M P.	August. Earths Mean Motion.	M P.
	s ° ' "	"	s ° ' "	"	s ° ' "	"	s ° ' "	"
1	3 29 15 48	17	4 29 49 06	21	5 29 23 16	25	6 29 56 34	29
2	4 00 14 56	17	5 00 48 14	21	6 00 22 24	25	7 00 55 42	29
3	4 01 14 04	17	5 01 47 23	21	6 01 21 32	25	7 01 54 51	29
4	4 02 13 13	17	5 02 46 31	21	6 02 20 40	25	7 02 33 59	30
5	4 03 12 21	17	5 03 45 39	21	6 03 19 49	25	7 03 53 07	30
6	4 04 11 29	17	5 04 44 48	21	6 04 18 57	26	7 04 52 16	30
7	4 05 10 38	17	5 05 43 56	22	6 05 18 06	26	7 05 51 24	30
8	4 06 09 46	17	5 06 43 04	22	6 06 17 14	26	7 06 50 32	30
9	4 07 08 54	18	5 07 42 13	22	6 07 16 22	26	7 07 49 41	30
10	4 08 08 03	18	5 08 41 21	22	6 08 15 31	26	7 08 48 49	30
11	4 09 07 11	18	5 09 40 29	22	6 09 14 39	26	7 09 47 57	31
12	4 10 06 19	18	5 10 39 38	22	6 10 13 47	26	7 10 47 06	31
13	4 11 05 28	18	5 11 38 46	22	6 11 12 56	27	7 11 46 14	31
14	4 12 04 36	18	5 12 37 54	23	6 12 12 04	27	7 12 45 22	31
15	4 13 03 44	18	5 13 37 03	23	6 13 11 12	27	7 13 44 31	31
16	4 14 02 53	19	5 14 36 11	23	6 14 10 21	27	7 14 43 39	31
17	4 15 02 01	19	5 15 35 19	23	6 15 09 29	27	7 15 42 47	31
18	4 16 01 09	19	5 16 34 28	23	6 16 08 37	27	7 16 41 56	31
19	4 17 00 18	19	5 17 33 36	23	6 17 07 46	27	7 17 41 04	32
20	4 17 59 26	19	5 18 32 44	23	6 18 06 54	28	7 18 40 12	32
21	4 18 58 34	19	5 19 31 53	24	6 19 06 02	28	7 19 39 21	32
22	4 19 57 42	19	5 20 31 01	24	6 20 05 11	28	7 20 38 29	32
23	4 20 56 51	20	5 21 30 09	24	6 21 04 19	28	7 21 37 37	32
24	4 21 55 59	20	5 22 29 18	24	6 22 03 27	28	7 22 36 46	32
25	4 22 55 0[illegible]	20	5 23 28 26	2[illegible]	6 23 02 36	28	7 23 35 54	32
26	4 23 54 16	[illegible]	5 24 27 34	24	6 24 01 44	28	7 24 35 02	33
27	4 24 53 24	20	5 25 26 43	24	6 25 00 52	28	7 25 34 11	33
28	4 25 52 33	20	5 26 25 51	24	6 26 00 01	29	7 26 33 19	33
29	4 26 51 41	20	5 27 24 59	25	6 26 59 09	29	7 27 32 27	33
30	4 27 50 49	21	5 28 24 08	25	6 27 58 17	29	7 28 31 36	33
31	4 28 49 58	21			6 28 57 26	29	7 29 30 44	33

A TABLE *of the Earths Mean Motions.*

Days	Septemb.					October.					November.					December.				
	Earths Mean Motion.				M P.	Earths Mean Motion.				M P.	Earths Mean Motion.				M P.	Earths Mean Motion.				M P.
	s	°	'	"	"	s	°	'	"	"	s	°	'	"	"	s	°	'	"	"
1	8	00	29	52	33	9	00	04	02	38	10	00	37	20	42	11	00	11	30	46
2	8	01	29	01	34	9	01	03	10	38	10	01	36	29	42	11	01	10	38	46
3	8	02	28	09	34	9	02	02	19	38	10	02	35	37	42	11	02	09	47	46
4	8	03	27	17	34	9	03	01	27	38	10	03	34	45	42	11	03	08	55	46
5	8	04	26	36	34	9	04	00	35	38	10	04	33	54	42	11	04	08	03	46
6	8	05	25	34	34	9	04	59	44	38	10	05	33	02	42	11	05	07	12	47
7	8	06	24	42	34	9	05	58	52	38	10	06	32	10	43	11	06	06	20	47
8	8	07	23	51	34	9	06	58	00	38	10	07	31	19	43	11	07	05	28	47
9	8	08	22	59	35	9	07	57	08	39	10	08	30	27	43	11	08	04	37	47
10	8	09	22	07	35	9	08	56	17	39	10	09	29	35	43	11	09	03	45	47
11	8	10	21	16	35	9	09	55	25	39	10	10	28	44	43	11	10	02	53	47
12	8	11	20	24	35	9	10	54	34	39	10	11	27	52	43	11	11	02	02	47
13	8	12	19	32	35	9	11	53	42	39	10	12	27	00	43	11	12	01	10	48
14	8	13	18	41	35	9	12	52	50	3[illegible]	10	13	26	09	44	11	13	00	18	48
15	8	14	17	49	35	9	13	51	59	39	10	14	25	17	44	11	13	59	27	48
16	8	15	16	57	36	9	14	51	07	40	10	15	24	25	44	11	14	58	35	48
17	8	16	16	05	36	9	15	50	15	4[illegible]	10	16	23	34	44	11	15	57	43	48
18	8	17	15	14	36	9	16	49	24	[illegible]	10	17	22	42	44	11	16	56	52	48
19	8	18	14	22	36	9	17	48	32	[illegible]	10	18	21	50	44	11	17	56	00	48
20	8	19	13	30	36	9	18	47	40	40	10	19	20	59	44	11	18	55	08	48
21	8	20	12	39	36	9	19	46	49	40	10	20	20	07	44	11	19	54	17	49
22	8	21	11	47	36	9	20	45	57	4[illegible]	10	21	19	1[illegible]	45	11	20	53	25	49
23	8	22	10	55	36	9	21	45	05	[illegible]	10	22	18	24	[illegible]5	11	21	52	33	49
24	8	23	10	04	37	9	22	44	14	41	10	23	17	32	45	11	22	51	42	49
25	8	24	09	12	37	9	23	43	2[illegible]	41	10	24	16	40	[illegible]5	11	[illegible]	[illegible]	[illegible]	49
26	8	25	08	20	37	9	24	42	3[illegible]	4[illegible]	10	25	15	49	45	11	24	49	58	49
27	8	26	07	29	37	9	25	41	3[illegible]	4[illegible]	10	26	14	57	45	11	25	49	07	49
28	8	27	06	37	37	9	26	40	47	41	10	27	14	05	45	11	26	48	15	49
29	8	28	05	45	37	9	27	39	55	41	10	28	13	13	46	11	27	47	23	50
30	8	29	04	54	37	9	28	39	04	[illegible]1	10	29	12	22	46	11	28	46	3[illegible]	50
31						9	29	38	12	42						11	29	45	40	50

In the Leap-year after *February* add a Day to the given time, and its Motion to the Motions Collected.

A TABLE *of the Earths Mean Motions to Hours, and Parts of an Hour.*

H.	°	'	"	H.	°	'	"
'	'	"	‴	'	'	"	‴
"	"	‴	⁗	"	"	‴	⁗
0	0	00	00	30	1	13	55
1	0	02	28	31	1	16	23
2	0	04	56	32	1	18	51
3	0	07	24	33	1	21	19
4	0	09	51	34	1	23	47
5	0	12	19	35	1	26	14
6	0	14	47	36	1	28	42
7	0	17	15	37	1	31	10
8	0	19	43	38	1	33	38
9	0	22	11	39	1	36	06
10	0	24	38	40	1	38	34
11	0	27	06	41	1	41	02
12	0	29	34	42	1	43	29
13	0	32	02	43	1	45	57
14	0	34	30	44	1	48	25
15	0	36	58	45	1	50	53
16	0	39	25	46	1	53	21
17	0	41	53	47	1	55	49
18	0	44	21	48	1	58	16
19	0	46	49	49	2	00	44
20	0	49	17	50	2	03	12
21	0	51	45	51	2	05	40
22	0	54	13	52	2	08	08
23	0	56	40	53	2	10	36
24	0	59	08	54	2	13	03
25	1	01	36	55	2	15	31
26	1	04	04	56	2	17	59
27	1	06	32	57	2	20	27
28	1	09	00	58	2	25	55
29	1	11	27	59	2	22	23
30	1	13	55	60	2	25	50

A TABLE *of the Equations of the Earths Orbit.*

Subtract.

	Sign. 0	1	2	3	4	5	
	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	
0	0 00 00	0 56 28	1 38 33	1 54 59	1 40 37	0 58 33	30
1	0 01 57	0 58 11	1 39 33	1 54 59	1 39 37	0 56 46	29
2	0 03 55	0 59 52	1 40 31	1 55 00	1 38 35	0 54 59	28
3	0 05 53	1 01 33	1 41 28	1 54 57	1 37 32	0 53 11	27
4	0 07 51	1 03 12	1 42 24	1 54 52	1 36 27	0 51 22	26
5	0 09 49	1 04 50	1 43 17	1 54 45	1 35 19	0 49 31	25
6	0 11 47	1 06 27	1 44 09	1 54 36	1 34 10	0 47 40	24
7	0 13 44	1 08 03	1 44 58	1 54 25	1 32 59	0 45 48	23
8	0 15 40	1 09 38	1 45 46	1 54 12	1 31 47	0 43 55	22
9	0 17 37	1 11 12	1 46 31	1 53 57	1 30 32	0 42 01	21
10	0 19 34	1 12 45	1 47 16	1 53 38	1 29 16	0 40 06	20
11	0 21 30	1 14 16	1 47 58	1 53 18	1 27 58	0 38 11	19
12	0 23 25	1 15 46	1 48 38	1 52 57	1 26 39	0 36 14	18
13	0 25 21	1 17 14	1 49 17	1 52 34	1 25 18	0 34 17	17
14	0 27 16	1 18 42	1 49 53	1 52 08	1 23 55	0 32 20	16
15	0 29 10	1 20 08	1 50 27	1 51 40	1 22 31	0 30 22	15
16	0 31 04	1 21 32	1 50 59	1 51 09	1 21 05	0 28 23	14
17	0 32 57	1 22 55	1 51 29	1 50 37	1 19 38	0 26 24	13
18	0 34 50	1 24 16	1 51 58	1 50 03	1 18 08	0 24 24	12
19	0 36 43	1 25 37	1 52 24	1 49 28	1 16 38	0 22 23	11
20	0 38 35	1 26 56	1 52 48	1 48 50	1 15 06	0 20 22	10
21	0 40 25	1 28 12	1 53 11	1 48 09	1 13 32	0 18 21	9
22	0 42 15	1 29 27	1 53 31	1 47 27	1 11 57	0 16 20	8
23	0 44 05	1 30 41	1 53 49	1 46 43	1 10 22	0 14 19	7
24	0 45 54	1 31 53	1 54 06	1 45 56	1 08 44	0 12 16	6
25	0 47 42	1 33 04	1 54 19	1 45 08	1 07 05	0 10 14	5
26	0 49 28	1 34 12	1 54 31	1 44 18	1 05 25	0 08 12	4
27	0 51 15	1 35 20	1 54 41	1 43 25	1 03 44	0 06 09	3
28	0 53 00	1 36 26	1 54 50	1 42 31	1 02 01	0 04 06	2
29	0 54 44	1 37 30	1 54 55	1 41 35	1 00 18	0 02 03	1
30	0 56 28	1 38 33	1 54 59	1 40 37	0 58 33	0 00 00	0
	Sign. 11	10	9	8	7	6	

Add.

A TABLE *of the Mean Motions of the Moon, her Apoge and Node.*

Years of Christ	Moons Motion from the vernal Equinox.	Motion of the Apoge from the Equinox.	Motion of the Node from the Equinox.
	s ° ′ ″	s ° ′ ″	s ° ′ ″
1	04 02 30 22	09 12 11 51	08 28 33 10
1501	01 29 40 22	03 29 41 51	01 25 46 34
1581	07 23 55 18	04 15 01 51	10 08 25 40
1601	00 07 29 02	07 18 51 51	09 11 35 27
21	04 21 02 46	10 22 41 51	08 14 45 15
41	09 04 36 30	01 26 31 51	07 17 55 01
61	01 18 10 14	05 00 21 51	06 21 04 47
81	06 01 43 58	08 04 11 51	05 24 14 33
82	10 11 07 01	09 14 51 41	05 04 14 50
83	02 20 30 03	10 25 31 30	04 15 35 07
84	06 29 53 06	00 06 11 20	03 26 15 22
85	11 22 26 43	01 16 57 51	03 06 52 30
86	04 01 49 45	02 27 37 40	02 18 32 47
87	08 11 12 47	04 08 17 30	01 28 13 04
88	00 19 35 50	05 18 57 20	01 08 53 21
89	05 13 09 27	06 29 43 51	00 19 30 28
90	09 22 32 30	08 10 23 41	00 00 10 45
91	02 01 55 32	09 21 03 30	11 10 51 01
92	06 11 18 35	11 01 43 20	10 22 31 18
93	11 04 02 13	00 12 29 51	10 02 08 25
94	03 12 14 15	01 23 09 41	09 12 48 42
95	07 22 38 18	03 03 49 30	08 23 28 59
96	00 02 01 20	04 14 29 20	08 04 09 16
97	04 24 34 58	05 25 15 51	07 14 46 22
98	09 03 58 00	07 05 55 41	06 25 27 39
99	01 13 21 02	08 17 05 30	06 06 07 56
1700	05 22 44 05	09 27 15 20	05 16 47 13
1701	10 15 17 44	11 08 01 51	04 27 24 20
1721	02 28 51 26	02 11 51 51	04 00 34 08
1741	07 12 25 10	05 15 41 51	03 03 43 55
1761	11 25 58 54	08 19 31 51	02 06 53 41
1781	04 09 32 38	11 23 21 51	01 10 03 28
1801	08 23 06 22	02 27 11 51	00 13 13 14

Com. Years Comp	Moons Mean Motion.	Mean Motion of the Apoge.	Mean Motion of the Node.
	s ° ′ ″	s ° ′ ″	s ° ′ ″
1	04 09 23 03	01 10 39 50	00 19 59 43
2	08 18 46 05	02 21 19 39	01 08 39 26
3	00 28 09 08	04 01 59 29	01 27 59 09
4	05 20 42 45	05 12 46 00	02 17 22 03
5	10 00 05 47	06 23 25 50	03 06 41 46
6	02 09 28 49	08 04 05 39	03 26 01 29
7	06 18 51 52	09 14 45 29	04 15 21 12
8	11 11 25 29	10 25 32 00	05 04 44 05
9	03 20 48 32	00 06 11 50	05 24 03 48
10	08 00 11 34	01 16 51 39	06 13 23 32
11	00 09 34 37	02 27 31 29	07 02 43 15
12	05 02 18 15	04 08 18 00	07 22 06 08
13	09 11 31 17	05 18 57 50	08 11 25 51
14	01 20 54 20	06 29 37 39	09 00 45 34
15	06 00 17 22	08 10 17 29	09 20 05 17
16	10 22 51 00	09 21 04 00	10 09 28 11
17	03 02 14 02	11 01 43 50	10 28 47 54
18	07 11 37 04	00 12 23 39	11 18 07 37
19	11 21 00 07	01 23 03 29	00 07 27 20
20	04 13 33 46	03 03 50 00	00 26 50 13
40	08 27 07 28	06 07 40 00	01 23 40 27
60	01 10 41 12	09 11 30 00	02 20 30 40
80	05 24 14 56	00 15 20 00	03 17 20 54
100	01 07 48 40	03 19 10 00	04 14 11 07
200	08 15 37 20	07 08 20 00	08 28 22 13
300	06 23 26 00	10 27 30 00	01 12 33 20
400	05 01 14 40	02 16 40 00	05 26 44 27
500	03 09 03 20	06 05 50 00	10 10 55 33
600	01 16 52 00	09 25 00 00	02 25 06 40
700	11 24 40 40	01 14 10 00	07 09 17 47
800	10 02 29 20	05 03 20 00	11 23 28 53
900	08 10 18 00	08 22 30 00	04 07 40 00
1000	06 13 06 40	00 11 40 00	08 21 51 07
2000	01 06 13 20	00 23 20 00	05 13 42 14
3000	07 24 20 00	01 05 00 00	02 05 33 20
4000	02 12 26 40	01 16 40 00	10 27 24 27
5000	09 00 33 20	01 28 20 00	07 19 15 34

A TABLE *of the Mean Motions of the Moon, her Apoge, and Node, to every Day in the Year.*

January.

Days.	Moons Mean Motion.				Apoge.			Node Retrogr.		
	s	°	′	″	°	′	″	°	′	″
1	00	13	10	35	0	06	41	0	03	11
2	00	26	21	10	0	13	22	0	06	21
3	01	09	31	45	0	20	03	0	09	32
4	01	22	42	20	0	26	44	0	12	43
5	02	05	52	55	0	33	25	0	15	53
6	02	19	03	30	0	40	06	0	19	04
7	03	02	14	05	0	46	48	0	22	14
8	03	15	24	40	0	53	29	0	25	25
9	03	28	35	15	1	00	10	0	28	36
10	04	11	45	50	1	06	51	0	31	46
11	04	24	56	25	1	13	32	0	34	57
12	05	08	07	00	1	20	13	0	38	08
13	05	21	17	35	1	26	54	0	41	18
14	06	04	28	10	1	33	35	0	44	29
15	06	17	38	45	1	40	16	0	47	40
16	07	00	49	20	1	46	57	0	50	50
17	07	13	59	55	1	53	38	0	54	01
18	07	27	10	30	2	00	19	0	57	11
19	08	10	21	05	2	07	00	1	00	22
20	08	23	31	40	2	13	41	1	03	33
21	09	06	42	15	2	20	28	1	06	43
22	09	19	52	50	2	27	0[illegible]	1	09	54
23	10	03	03	25	2	33	45	1	13	05
24	10	16	14	00	2	40	26	1	16	1[illegible]
25	10	29	24	35	2	47	07	1	19	26
26	11	12	35	10	2	53	48	1	22	37
27	11	25	45	45	3	00	29	1	25	47
28	00	08	56	20	3	07	10	1	28	58
29	00	22	06	55	3	13	51	1	32	09
30	01	05	17	31	3	20	32	1	35	19
31	01	18	28	06	3	27	13	1	38	30

February.

Days.	Moons Mean Motion.				Apoge.			Node Retrogr.		
	s	°	′	″	°	′	″	°	′	″
1	02	01	38	41	3	33	54	1	41	40
2	02	14	49	16	3	40	35	1	44	50
3	02	27	59	51	3	47	16	1	48	01
4	03	11	10	26	3	53	57	1	51	12
5	03	24	21	01	4	00	38	1	54	23
6	04	07	31	36	4	07	19	1	57	33
7	04	20	42	11	4	14	00	2	00	44
8	05	03	52	46	4	20	41	2	03	54
9	05	17	03	21	4	27	22	2	07	06
10	06	00	13	56	4	34	04	2	10	16
11	06	13	24	31	4	40	45	2	13	27
12	06	26	35	06	4	47	26	2	16	47
13	07	09	45	41	4	54	07	2	19	08
14	07	22	56	15	5	00	48	2	22	59
15	08	06	06	50	5	07	29	2	26	09
16	08	19	17	26	5	14	10	2	29	20
17	09	02	28	01	5	20	51	2	32	30
18	09	15	38	36	5	27	32	2	35	41
19	09	28	49	11	5	34	13	2	38	52
20	10	11	59	46	5	40	54	2	42	02
21	10	25	10	21	5	47	36	2	45	13
22	11	08	20	56	5	54	17	2	48	23
23	11	21	31	31	6	00	58	2	51	34
24	00	04	42	06	6	07	39	2	54	45
25	00	17	52	4[illegible]	6	14	20	2	57	55
26	01	01	03	16	6	21	01	3	01	06
27	01	14	13	51	6	27	42	3	04	16
28	01	27	24	26	6	34	23	3	07	27

March.

Days.	Moons Mean Motion.				Apoge.			Node Retrogr.		
	s	°	′	″	°	′	″	°	′	″
1	02	10	35	01	06	41	04	03	10	38
2	02	23	45	36	06	47	45	03	13	49
3	03	06	56	11	06	54	26	03	16	59
4	03	20	06	46	07	01	07	03	20	10
5	04	03	17	21	07	07	48	03	23	20
6	04	16	27	56	07	14	29	03	26	31
7	04	29	38	31	07	21	11	03	29	42
8	05	12	49	06	07	27	52	03	32	52
9	05	25	59	41	07	34	33	03	36	03
10	06	09	10	16	07	41	14	03	39	14
11	06	22	20	51	07	47	55	03	42	25
12	07	05	31	26	07	54	36	03	45	36
13	07	18	42	01	08	01	17	03	48	46
14	08	01	52	36	08	07	58	03	51	56
15	08	15	03	11	08	14	39	03	55	07
16	08	28	13	46	08	21	20	03	58	18
17	09	11	24	21	8	28	01	04	01	28
18	09	24	34	56	8	34	42	04	04	39
19	10	07	45	31	8	41	23	04	07	49
20	10	20	56	07	8	48	04	04	11	00
21	11	04	06	42	8	54	45	04	14	11
22	11	17	17	17	9	01	27	04	17	22
23	00	00	27	52	9	08	08	04	20	32
24	00	13	38	27	09	14	49	04	23	43
25	00	26	49	02	09	21	30	04	26	53
26	01	09	59	37	09	28	11	04	30	04
27	01	23	10	12	09	34	52	04	33	15
28	02	06	20	47	09	41	33	04	36	25
29	02	19	31	22	09	48	14	04	39	36
30	03	02	41	57	09	54	55	04	42	47
31	03	15	52	32	10	01	36	04	45	58

April.

Days.	Moons Mean Motion.				Apoge.			Node Retrogr.		
	s	°	′	″	°	′	″	°	′	″
1	03	29	03	07	10	08	17	04	49	08
2	04	12	13	42	10	14	58	04	52	19
3	04	25	24	17	10	21	39	04	55	29
4	05	08	34	52	10	28	20	04	58	40
5	05	21	45	27	10	35	02	05	01	51
6	06	04	56	02	10	41	43	05	05	01
7	06	18	06	38	10	48	24	05	08	12
8	07	01	17	12	10	55	05	05	11	22
9	07	14	27	47	11	01	46	05	14	33
10	07	27	38	22	11	08	27	05	17	44
11	08	10	48	57	11	15	08	05	20	54
12	08	23	59	32	11	21	49	05	24	05
13	09	07	10	07	11	28	30	05	27	16
14	09	20	20	42	11	35	11	05	30	26
15	10	03	31	17	11	41	52	05	33	37
16	10	16	41	52	11	48	33	05	36	48
17	10	29	52	27	11	55	14	05	39	58
18	11	13	03	02	12	01	55	05	43	09
19	11	26	13	37	12	08	36	05	46	19
20	00	09	24	12	12	15	18	05	49	31
21	00	22	34	47	12	21	59	05	52	41
22	01	05	45	22	12	28	40	05	55	52
23	01	18	55	57	12	35	21	05	59	02
24	02	02	06	37	12	42	02	06	02	13
25	02	15	17	07	12	48	43	06	05	24
26	02	28	27	42	12	55	24	06	08	34
27	03	11	38	17	13	02	05	06	11	45
28	03	24	48	52	13	08	46	06	14	56
29	04	07	59	27	13	15	27	06	18	06
30	04	21	10	03	13	22	08	06	21	17

A TABLE *of the Mean Motions of the Moon, her Apoge, and Node, to every Day in the Year.*

May.

Days.	Moons Mean Motion.				Apoge.			Node Retrogr.		
	s	°	′	″	°	′	″	°	′	″
1	05	04	20	37	13	28	49	06	24	27
2	05	17	31	12	13	35	30	06	27	38
3	06	00	41	47	13	42	11	06	30	48
4	06	13	52	22	13	48	52	06	33	59
5	06	27	02	57	13	55	34	06	37	10
6	07	10	13	32	14	02	15	06	40	20
7	07	23	24	07	14	08	56	06	43	31
8	08	06	34	42	14	15	37	06	46	41
9	08	19	45	17	14	22	18	06	49	52
10	09	02	55	53	14	28	59	06	53	03
11	09	16	06	27	14	35	40	06	56	18
12	09	29	17	03	14	42	21	06	59	24
13	10	12	27	38	14	49	02	07	02	34
14	10	25	38	13	14	55	43	07	05	45
15	11	08	48	48	15	02	34	07	08	56
16	11	21	59	23	15	09	05	07	12	06
17	00	05	09	58	15	15	46	07	15	17
18	00	18	20	33	15	22	28	07	18	27
19	01	01	38	08	15	29	09	07	21	38
20	01	14	41	43	15	35	50	07	24	49
21	01	27	52	18	15	42	31	07	28	00
22	02	11	02	53	15	49	12	07	31	10
23	02	24	13	28	15	55	53	07	34	21
24	03	07	24	03	16	02	34	07	37	32
25	03	20	34	38	16	09	15	07	40	43
26	04	03	45	13	16	15	56	07	43	53
27	04	16	55	48	16	22	37	07	47	04
28	05	00	06	23	16	29	18	07	50	14
29	05	13	16	58	16	35	59	07	53	25
30	05	26	27	33	16	42	40	07	56	36
31	06	09	38	08	16	49	21	07	59	46

June.

Days.	Moons Mean Motion.				Apoge.			Node Retrogr.		
	s	°	′	″	°	′	″	°	′	″
1	06	22	48	43	16	56	03	08	02	56
2	07	05	59	18	17	02	44	08	06	07
3	07	19	09	53	17	09	25	08	09	18
4	08	02	20	28	17	16	06	08	12	29
5	08	15	31	03	17	22	47	08	15	39
6	08	28	41	38	17	29	28	08	18	50
7	09	11	52	13	17	36	09	08	22	00
8	09	25	02	48	17	42	50	08	25	11
9	10	08	13	23	17	49	31	08	28	22
10	10	21	23	58	17	56	12	08	31	32
11	11	04	34	33	18	02	53	08	34	43
12	11	17	45	08	18	09	34	08	37	54
13	00	00	55	43	18	16	15	08	41	05
14	00	14	06	18	18	22	56	08	44	16
15	00	27	16	53	18	29	37	08	47	26
16	01	10	27	28	18	36	19	08	50	37
17	01	23	38	03	18	43	00	08	53	47
18	02	06	48	38	18	49	41	08	56	58
19	02	19	59	13	18	56	22	09	00	09
20	03	03	09	48	19	03	03	09	03	19
21	03	16	20	23	19	09	44	09	06	30
22	03	29	30	58	19	16	25	09	09	40
23	04	12	41	33	19	23	06	09	12	51
24	04	25	52	08	19	29	47	09	16	02
25	05	09	02	43	19	36	28	09	19	12
26	05	22	13	18	19	43	09	09	22	23
27	06	05	23	53	19	49	50	09	25	34
28	06	18	34	28	19	56	31	09	28	45
29	07	01	45	04	20	03	12	09	31	55
30	07	14	55	39	20	09	54	09	35	06

July.

Days.	Moons Mean Motion.				Apoge.			Node Retrogr.		
	s	°	′	″	°	′	″	°	′	″
1	07	28	06	14	20	16	35	09	38	16
2	08	11	16	49	20	23	16	09	41	27
3	08	24	27	24	20	29	57	09	44	37
4	09	07	37	59	20	36	38	09	47	4[illegible]
5	09	20	48	34	20	43	1[illegible]	09	50	59
6	10	03	59	09	20	50	00	09	54	09
7	10	17	09	44	20	56	41	09	57	20
8	11	00	20	19	21	03	22	10	00	30
9	11	13	30	54	21	10	03	10	03	41
10	11	26	41	29	21	16	44	10	06	51
11	00	09	52	04	21	23	25	10	10	02
12	00	23	02	39	21	30	06	10	13	13
13	01	06	13	14	21	36	47	10	16	24
14	01	19	23	49	21	43	28	10	19	35
15	02	02	34	24	21	50	09	10	22	45
16	02	15	44	59	21	56	5[illegible]	10	25	56
17	02	28	55	34	22	03	32	10	29	06
18	03	12	06	09	22	10	13	10	32	17
19	03	25	16	44	22	16	54	10	35	28
20	04	08	27	19	22	23	35	10	38	39
21	04	21	37	54	22	30	15	10	41	49
22	05	04	48	2[illegible]	22	36	56	10	45	00
23	05	17	59	04	22	43	3[illegible]	10	48	11
24	06	01	09	39	22	50	19	10	51	21
25	06	14	20	14	22	57	00	10	54	32
26	06	27	30	49	23	03	41	10	57	42
27	07	10	41	2[illegible]	23	10	22	11	00	53
28	07	23	51	59	23	17	03	11	04	03
29	08	07	02	34	23	23	44	11	07	14
30	08	20	13	09	23	30	25	11	10	25
31	09	03	23	44	23	37	06	11	13	36

August.

Days.	Moons Mean Motion.				Apoge.			Node Retrogr.		
	s	°	′	″	°	′	″	°	′	″
1	09	16	34	19	23	43	47	11	16	47
2	09	29	44	54	23	50	28	11	19	58
3	10	12	55	29	23	57	09	11	23	08
4	10	26	06	04	24	03	51	11	26	19
5	11	09	16	39	24	10	32	11	29	29
6	11	22	27	14	24	17	13	11	32	40
7	00	05	37	49	24	23	54	11	35	51
8	00	18	48	24	24	30	35	11	39	02
9	01	01	58	59	24	37	16	11	42	12
10	01	15	09	34	24	43	57	11	45	23
11	01	28	20	09	24	50	38	11	48	33
12	02	11	30	44	24	57	19	11	51	44
13	02	24	41	19	25	04	00	11	54	54
14	03	07	51	54	25	10	42	11	58	05
15	03	21	02	29	25	17	23	12	01	15
16	04	04	13	04	25	24	04	12	04	26
17	04	17	23	[illegible]	25	30	45	12	07	36
18	05	00	34	15	25	37	26	12	10	47
19	05	13	44	50	25	44	07	12	13	58
20	05	26	55	25	25	50	4[illegible]	12	17	08
21	06	10	06	00	25	57	29	12	20	19
22	06	23	16	35	26	04	10	12	23	29
23	07	06	27	10	26	10	51	12	26	40
24	07	19	37	45	26	17	32	12	29	51
25	08	02	48	20	26	24	13	12	33	01
26	08	15	58	55	26	30	55	12	36	12
27	08	29	09	30	26	37	36	12	39	23
28	09	12	20	0[illegible]	26	44	17	12	42	34
29	09	25	30	40	26	50	58	12	45	44
30	10	08	41	[illegible]	26	57	39	12	48	5[illegible]
31	10	2[illegible]	51	[illegible]	27	04	2[illegible]	12	52	0[illegible]

A TABLE *of the Mean Motions of the Moon, her Apoge, and Node, to every Day in the Year.*

September.

Days.	Moons Mean Motion.				Apoge.				Node Retrogr.		
	s	°	'	"	s	°	'	"	°	'	"
1	11	05	02	25	0	27	11	01	12	55	16
2	11	18	13	00	0	27	17	42	12	58	27
3	00	01	23	35	0	27	24	23	13	01	37
4	00	14	34	10	0	27	31	04	13	04	48
5	00	27	44	45	0	27	37	45	13	07	58
6	01	10	55	20	0	27	44	26	13	11	09
7	01	24	05	55	0	27	51	07	13	14	20
8	02	07	16	30	0	27	57	48	13	17	31
9	02	20	27	05	0	28	04	29	13	20	41
10	03	03	37	40	0	28	11	11	13	23	52
11	03	16	48	15	0	28	17	52	13	27	03
12	03	29	58	50	0	28	24	33	13	30	14
13	04	13	09	25	0	28	31	14	13	33	24
14	04	26	20	00	0	28	37	55	13	36	35
15	05	09	30	35	0	28	44	36	13	39	45
16	05	22	41	10	0	28	51	17	13	42	56
17	06	05	51	45	0	28	57	58	13	46	07
18	06	19	02	20	0	29	04	39	13	49	17
19	07	02	12	55	0	29	11	20	13	52	28
20	07	15	23	30	0	29	18	01	13	55	39
21	07	28	34	05	0	29	24	42	13	58	4[illegible]
22	08	11	44	40	0	29	31	23	14	02	00
23	08	24	55	15	0	29	38	04	14	05	10
24	09	08	05	50	0	29	44	45	14	08	21
25	09	21	16	25	0	29	51	27	14	11	31
26	10	04	27	00	0	29	58	08	14	14	42
27	10	17	37	35	1	00	04	49	14	17	53
28	11	00	48	10	1	00	11	30	14	21	03
29	11	13	58	45	1	00	18	11	14	24	14
30	11	27	09	20	1	00	24	52	14	27	24

October.

Days.	Moons Mean Motion.				Apoge.				Node Retrogr.		
	s	°	'	"	s	°	'	"	°	'	"
1	00	10	19	55	1	00	31	33	14	30	35
2	00	23	30	30	1	00	38	14	14	33	46
3	01	06	41	05	1	00	44	55	14	36	56
4	01	19	51	40	1	00	51	36	14	40	07
5	02	03	02	15	1	00	58	17	14	43	17
6	02	16	12	50	1	01	04	58	14	46	28
7	02	29	23	26	1	01	11	39	14	49	39
8	03	12	34	01	1	01	18	20	14	52	50
9	03	25	44	36	1	01	25	02	14	56	00
10	04	08	55	11	1	01	31	43	14	59	11
11	04	22	05	46	1	01	38	24	15	02	21
12	05	05	16	21	1	01	45	05	15	05	32
13	05	18	26	56	1	01	51	46	15	08	43
14	06	01	37	31	1	01	58	27	15	11	53
15	06	14	48	06	1	02	05	08	15	15	04
16	06	27	58	41	1	02	11	49	15	18	15
17	07	11	09	16	1	02	18	30	15	21	26
18	07	24	19	51	1	02	25	11	15	24	36
19	08	07	30	26	1	02	31	52	15	27	47
20	08	20	41	01	1	02	38	33	15	30	57
21	09	03	51	36	1	02	45	14	15	34	08
22	09	17	02	11	1	02	51	55	15	37	19
23	10	00	12	46	1	02	58	36	15	40	29
24	10	13	23	21	1	03	05	17	15	43	40
25	10	26	33	56	1	03	11	58	15	46	50
26	11	09	44	31	1	03	18	3[illegible]	15	50	01
27	11	22	55	06	1	03	25	21	15	53	12
28	00	06	05	41	1	03	32	02	15	56	22
	00	19	16	16	1	03	38	42	15	59	33
	11	02	26	35	1	03	45	24	16	02	43
	01	15	37	26	1	03	52	05	16	05	54

November.

Days.	Moons Mean Motion.				Apoge.				Node Retrogr.		
	s	°	'	"	s	°	'	"	°	'	"
1	01	28	48	01	1	03	58	46	16	09	05
2	02	11	58	36	1	04	05	27	16	2	16
3	02	25	09	11	1	04	12	08	16	15	26
4	03	08	19	46	1	04	18	49	16	18	37
5	03	21	30	21	1	04	25	30	16	21	48
6	04	04	40	56	1	04	32	11	16	24	59
7	04	17	51	31	1	04	38	53	16	28	09
8	5	01	02	06	1	04	45	34	16	31	20
9	05	14	12	41	1	04	52	15	16	34	30
10	05	27	23	16	1	04	58	56	16	37	41
11	06	10	33	51	1	05	05	37	16	40	52
12	06	23	44	26	1	05	12	1[illegible]	16	44	02
13	07	06	55	01	1	05	18	59	16	47	13
14	07	20	05	36	1	05	25	40	16	50	23
15	08	03	16	11	1	05	32	21	16	53	34
16	08	16	26	46	1	05	39	02	16	56	45
17	08	29	37	21	1	05	45	43	16	59	55
18	09	12	47	56	1	05	52	24	17	03	06
19	09	25	58	31	1	05	59	05	17	06	16
20	10	09	09	06	1	06	05	46	17	09	27
21	10	22	19	41	1	06	12	27	17	12	38
22	11	05	30	16	1	06	19	09	17	15	49
23	11	18	40	51	1	06	25	50	17	18	59
24	00	01	51	26	1	06	32	31	17	22	10
25	00	15	02	02	1	06	39	12	17	25	21
26	00	28	12	37	1	06	45	53	17	28	32
27	01	11	23	12	1	06	52	34	17	31	42
28	01	24	33	47	1	06	59	15	17	34	53
29	02	07	44	22	1	07	05	56	17	38	03
30	02	20	54	57	1	07	12	37	17	41	14

December.

Days.	Moons Mean Motion.				Apoge.				Node Retrogr.		
	s	°	'	"	s	°	'	"	°	'	"
1	03	04	05	32	1	07	19	18	17	44	25
2	03	17	16	07	1	07	25	59	17	47	35
3	04	00	26	42	1	07	32	40	17	50	46
4	04	13	37	17	1	07	39	21	17	53	56
5	04	26	47	52	1	07	46	02	17	57	07
6	05	09	58	27	1	07	52	43	18	00	18
7	05	23	09	02	1	07	59	24	18	03	28
8	06	06	19	37	1	08	06	06	18	06	39
9	06	19	30	12	1	08	12	47	18	09	49
10	07	02	40	47	1	08	19	28	18	13	00
11	07	15	51	22	1	08	26	09	18	16	11
12	07	29	01	57	1	08	32	50	18	19	21
13	08	12	12	32	1	08	39	31	18	22	32
14	08	25	23	07	1	08	46	12	18	25	42
15	09	08	33	42	1	08	52	53	18	28	53
16	09	21	44	17	1	08	59	34	18	32	04
17	10	04	54	52	1	09	06	15	18	35	15
18	10	18	05	27	1	09	12	56	18	38	25
19	11	01	16	02	1	09	19	38	18	41	36
20	11	14	26	37	1	09	26	19	18	44	47
21	11	27	37	12	1	09	33	00	18	47	58
22	00	10	47	47	1	09	39	41	18	51	09
23	00	23	58	22	1	09	46	22	18	54	19
24	01	07	08	57	1	09	53	03	18	57	30
25	01	20	19	32	1	09	59	44	19	00	41
26	02	03	30	07	1	10	06	25	19	03	51
27	02	16	40	42	1	10	13	06	19	07	02
28	02	29	51	17	1	10	19	47	19	10	12
29	03	13	01	52	1	10	26	28	19	13	23
30	03	26	12	27	1	10	33	09	19	16	34
31	04	09	23	02	1	10	39	50	19	19	45

A TABLE of the Moons Mean Motions to Hours and Parts of an Hour.

H. ' "	° ' "	' " '''	" ''' ''''	' " '''	" ''' ''''	' " '''	" ''' ''''	H. ' "	° ' "	' " '''	" ''' ''''	' " '''	" ''' ''''	' " '''	" ''' ''''
0	0	00	00	0	00	0	00	30	16	28	14	8	21	3	58
1	0	32	56	0	17	0	08	31	17	01	10	8	38	4	06
2	1	05	53	0	33	0	16	32	17	34	07	8	54	4	14
3	1	38	49	0	50	0	24	33	18	07	03	9	11	4	22
4	2	11	46	1	07	0	32	34	18	39	59	9	28	4	30
5	2	44	42	1	24	0	40	35	19	12	55	9	45	4	38
6	3	17	39	1	40	0	48	36	19	45	52	10	02	4	46
7	3	50	35	1	57	0	56	37	20	18	48	10	19	4	54
8	4	23	32	2	14	1	04	38	20	51	45	10	36	5	02
9	4	56	28	2	30	1	12	39	21	24	41	10	52	5	10
10	5	29	25	2	47	1	19	40	21	57	38	11	08	5	18
11	6	02	21	3	04	1	27	41	22	30	34	11	25	5	26
12	6	35	18	3	21	1	35	42	23	03	31	11	42	5	34
13	7	08	14	3	37	1	43	43	23	36	27	11	59	5	42
14	7	41	10	3	54	1	51	44	24	09	24	12	16	5	50
15	8	14	07	4	11	1	59	45	24	42	20	12	32	5	58
16	8	47	03	4	27	2	07	46	25	15	17	12	48	6	06
17	9	20	00	4	44	2	15	47	25	48	13	13	05	6	14
18	9	52	56	5	01	2	23	48	26	21	10	13	22	6	22
19	10	25	53	5	18	2	31	49	26	54	06	13	39	6	30
20	10	58	49	5	34	2	39	50	27	27	03	13	56	6	38
21	11	31	46	5	51	2	47	51	27	59	59	14	13	6	46
22	12	04	42	6	08	2	55	52	28	32	56	14	30	6	54
23	12	37	39	6	24	3	03	53	29	05	52	14	46	7	01
24	13	10	35	6	41	3	11	54	29	38	49	15	02	7	08
25	13	43	32	6	58	3	19	55	30	11	45	15	19	7	16
26	14	16	28	7	15	3	27	56	30	44	42	15	36	7	24
27	14	49	24	7	31	3	34	57	31	17	38	15	53	7	32
28	15	22	21	7	48	3	42	58	31	50	34	16	10	7	40
29	15	55	17	8	05	3	50	59	32	23	31	16	26	7	48
30	16	28	14	8	21	3	58	60	32	56	27	16	43	7	56

In the Leap-year after *February* add a Day to the given time, and its Motions to the Motions Collected.

A TABLE of Physical Parts, to be added to or subtracted from the Moons Mean Motion, according to the Suns Mean Anomaly.

Suns Mean Anomaly.	Add.												
	0		1		2		3		4		5		
	'	"	'	"	'	"	'	"	'	"	'	"	
0	0	00	5	36	9	51	11	30	10	04	5	51	30
1	0	12	5	47	9	57	11	30	9	58	5	40	29
2	0	23	5	58	10	03	11	30	9	51	5	30	28
3	0	35	6	09	10	09	11	30	9	45	5	19	27
4	0	47	6	19	10	14	11	29	9	39	5	08	26
5	0	59	6	29	10	19	11	28	9	32	4	57	25
6	1	10	6	39	10	25	11	27	9	25	4	46	24
7	1	22	6	48	10	30	11	26	9	18	4	35	23
8	1	33	6	58	10	34	11	25	9	11	4	23	22
9	1	45	7	07	10	39	11	24	9	03	4	12	21
10	1	56	7	16	10	43	11	22	8	55	4	00	20
11	2	08	7	25	10	48	11	20	8	48	3	49	19
12	2	19	7	34	10	52	11	18	8	40	3	37	18
13	2	31	7	43	10	56	11	15	8	32	3	25	17
14	2	42	7	52	10	59	11	13	8	23	3	14	16
15	2	54	8	01	11	02	11	10	8	15	3	02	15
16	3	05	8	09	11	06	11	07	8	06	2	50	14
17	3	16	8	17	11	09	11	04	7	58	2	38	13
18	3	27	8	25	11	12	11	00	7	49	2	26	12
19	3	39	8	33	11	14	10	57	7	40	2	14	11
20	3	50	8	41	11	17	10	53	7	30	2	02	10
21	4	01	8	49	11	19	10	50	7	21	1	50	9
22	4	12	8	57	11	21	10	45	7	12	1	38	8
23	4	22	9	04	11	23	10	40	7	02	1	26	7
24	4	33	9	11	11	24	10	35	6	52	1	13	6
25	4	44	9	18	11	26	10	31	6	42	1	01	5
26	4	55	9	25	11	27	10	26	6	32	0	49	4
27	5	05	9	32	11	28	10	20	6	22	0	37	3
28	5	16	9	38	11	29	10	15	6	12	0	24	2
29	5	26	9	45	11	29	10	09	6	02	0	12	1
30	5	36	9	51	11	30	10	04	5	51	0	00	0
	11		10		9		8		7		6		
	Subtract.												

The Equations of the Moons Apoge and the Excentricities of her Orbit, in such Parts as the Radius is, 1000000.

Add the Equations of the Apoge.

Annual Argu.	Sign 0 / 6 °	'	"	Excen. Parts.	Sign 1 / 7 °	'	"	Excen. Parts.	Sign 2 / 8 °	'	"	Excen. Parts.	Annual Argu.
0	0	00	00	66854	09	07	14	61045	11	08	55	49429	30
1	0	20	21	66847	09	20	52	60691	10	59	45	49082	29
2	0	40	42	66826	09	34	01	60330	10	49	35	48741	28
3	1	01	01	66791	09	46	40	59962	10	38	22	48408	27
4	1	21	17	66741	09	58	49	59589	10	26	07	48085	26
5	1	41	30	66678	10	10	24	59210	10	12	50	47769	25
6	2	01	40	66600	10	21	29	58827	09	58	31	47463	24
7	2	21	44	66509	10	31	58	58439	09	43	10	47167	23
8	2	41	42	66404	10	41	50	58047	09	26	48	46880	22
9	3	01	34	66286	10	51	08	57652	09	09	24	46604	21
10	3	21	18	66154	10	59	48	57254	08	51	00	46337	20
11	3	40	54	66008	11	07	47	56854	08	31	36	46082	19
12	4	00	21	65850	11	15	07	56451	08	11	14	45838	18
13	4	19	38	65679	11	21	45	56047	07	49	55	45606	17
14	4	38	44	65495	11	27	40	55642	07	27	40	45385	16
15	4	57	38	65298	11	32	51	55237	07	04	31	45176	15
16	5	16	20	65089	11	37	17	54832	06	40	30	44979	14
17	5	34	49	64868	11	40	55	54427	06	15	40	44795	13
18	5	53	02	64636	11	43	47	54023	05	50	02	44624	12
19	6	11	01	64392	11	45	49	53620	05	23	39	44466	11
20	6	28	43	64137	11	47	01	53220	04	56	34	44320	10
21	6	46	03	63870	11	47	22	52822	04	28	51	44188	9
22	7	03	15	63594	11	46	50	52427	04	00	32	44070	8
23	7	20	03	63307	11	45	24	52035	03	31	40	43965	7
24	7	36	30	63011	11	43	04	51647	03	02	20	43874	6
25	7	52	36	62705	11	39	47	51264	02	32	26	43796	5
26	8	08	20	62389	11	35	34	50885	02	02	30	43733	4
27	8	23	41	62066	11	30	23	50512	01	32	08	43683	3
28	8	38	38	61733	11	24	14	50144	01	01	30	43648	2
29	8	53	08	61392	11	17	05	59783	00	30	45	43627	1
30	9	07	14	61045	11	08	55	59429	00	00	00	43619	0
	Sign 5 / 11				Sign 4 / 10				Sign 9				

Subtract, &c.

A TABLE *of the Equations of the Moons Center.*

Subtract.

Mean Anomaly	Sign 0. Least Exc 43619 ° ' "	Sign 0. Middle. 55237 ° ' "	Sign 0. Greatest. 66854 ° ' "	Sign 1. Least Exc 43619 ° ' "	Sign 1. Middle. 55327 ° ' "	Sign 1. Greatest. 66854 ° ' "	Mean Anomaly
0	0 00 00	0 00 00	0 00 00	2 23 08	2 59 04	3 34 08	30
1	0 04 58	0 06 12	0 07 24	2 27 32	3 04 33	3 40 43	29
2	0 09 56	0 12 24	0 14 48	2 31 50	3 10 00	3 47 15	28
3	0 14 53	0 18 35	0 22 12	2 36 07	3 15 23	3 53 43	27
4	0 19 50	0 24 47	0 29 36	2 40 22	3 20 44	4 00 08	26
5	0 24 48	0 30 58	0 36 58	2 44 35	3 26 01	4 06 30	25
6	0 29 44	0 37 09	0 44 20	2 48 48	3 31 16	4 12 47	24
7	0 34 39	0 43 19	0 51 42	2 52 53	3 36 27	4 19 01	23
8	0 39 34	0 49 27	0 59 04	2 56 54	3 41 35	4 25 12	22
9	0 44 30	0 55 36	1 06 25	3 00 58	3 46 39	4 31 18	21
10	0 49 25	1 01 43	1 13 45	3 04 55	3 51 39	4 37 20	20
11	0 54 19	1 07 51	1 21 02	3 08 53	3 56 36	4 43 18	19
12	0 59 13	1 13 57	1 28 18	3 12 46	4 01 30	4 49 12	18
13	1 04 04	1 20 02	1 35 34	3 16 35	4 06 20	4 55 01	17
14	1 08 56	1 26 05	1 42 49	3 20 22	4 11 06	5 00 46	16
15	1 13 45	1 32 07	1 50 02	3 24 05	4 15 47	5 06 26	15
16	1 18 33	1 38 08	1 57 13	3 27 44	4 20 24	5 12 01	14
17	1 23 20	1 44 08	2 04 23	3 31 20	4 24 58	5 17 32	13
18	1 28 06	1 50 06	2 11 31	3 34 53	4 29 28	5 22 59	12
19	1 32 50	1 56 02	2 18 37	3 38 22	4 33 53	5 28 20	11
20	1 37 32	2 01 56	2 25 41	3 41 47	4 38 14	5 33 36	10
21	1 42 13	2 07 49	2 32 43	3 45 09	4 42 31	5 38 47	9
22	1 46 53	2 13 39	2 39 43	3 48 28	4 46 43	5 43 53	8
23	1 51 33	2 19 27	2 46 40	3 51 43	4 50 50	5 48 53	7
24	1 56 09	2 25 14	2 53 35	3 54 55	4 54 53	5 53 48	6
25	2 00 45	2 30 58	3 00 28	3 58 03	4 58 55	5 58 38	5
26	2 05 18	2 36 41	3 07 18	4 01 06	5 02 43	6 03 21	4
27	2 09 49	2 42 21	3 14 05	4 04 05	5 06 32	6 07 59	3
28	2 14 18	2 47 58	3 20 49	4 07 00	5 10 15	6 12 31	2
29	2 18 44	2 53 32	3 27 30	4 09 51	5 13 54	6 16 58	1
30	2 23 08	2 59 04	3 34 08	4 12 40	5 17 27	6 21 18	0
	Sign 11.			Sign 10.			

Add.

A TABLE of the Equations of the Moons Center.

Subtract.

Mean Anomaly	Sign 2. Least Exc 43619	Sign 2. Middle. 55327	Sign 2. Greatest. 66854	Sign 3. Least Exc 43619	Sign 3. Middle. 55327	Sign 3. Greatest. 66854	Mean Anomaly
	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	
0	4 12 40	5 17 27	6 21 18	4 59 30	6 18 59	7 38 17	30
1	4 15 18	5 20 54	6 25 32	4 59 48	6 19 23	7 38 52	29
2	4 17 56	5 24 17	6 29 39	4 59 56	6 19 40	7 39 20	28
3	4 20 28	5 27 35	6 33 40	4 59 59	6 19 50	7 39 40	27
4	4 23 00	5 30 47	6 37 36	4 59 58	6 19 54	7 39 51	26
5	4 25 24	5 33 53	6 41 25	4 59 49	6 19 51	7 39 53	25
6	4 27 44	5 36 54	6 45 08	4 59 36	6 19 40	7 39 47	24
7	4 30 00	5 39 49	6 48 44	4 59 20	6 19 23	7 39 33	23
8	4 32 12	5 42 39	6 52 14	4 58 53	6 18 57	7 39 09	22
9	4 34 19	5 45 24	6 55 36	4 58 24	6 18 25	7 38 37	21
10	4 36 21	5 48 02	6 58 52	4 57 48	6 17 46	7 37 58	20
11	4 38 18	5 50 35	7 02 01	4 57 06	6 17 00	7 37 09	19
12	4 40 12	5 53 02	7 05 03	4 56 19	6 16 08	7 36 12	18
13	4 41 58	5 55 22	7 07 57	4 55 27	6 15 08	7 35 06	17
14	4 43 41	5 57 36	7 10 45	4 54 30	6 14 00	7 33 52	16
15	4 45 19	5 59 44	7 13 25	4 53 27	6 12 46	7 32 29	15
16	4 46 53	6 01 46	7 15 58	4 52 19	6 11 25	7 30 57	14
17	4 48 22	6 03 42	7 18 21	4 51 03	6 09 56	7 29 17	13
18	4 49 44	6 05 31	7 20 42	4 49 45	6 08 20	7 27 28	12
19	4 51 02	6 07 15	7 22 53	4 48 21	6 06 37	7 25 30	11
20	4 52 15	6 08 52	7 24 56	4 46 51	6 04 48	7 23 23	10
21	4 53 22	6 10 23	7 26 52	4 45 16	6 02 51	7 21 08	9
22	4 54 23	6 11 46	7 28 39	4 43 34	6 00 48	7 18 44	8
23	4 55 20	6 13 03	7 30 26	4 41 44	5 58 37	7 16 12	7
24	4 56 12	6 14 14	7 31 52	4 39 56	5 56 19	7 13 30	6
25	4 56 59	6 15 19	7 33 16	4 37 58	5 53 54	7 10 40	5
26	4 57 38	6 16 17	7 34 32	4 35 56	5 51 23	7 07 42	4
27	4 58 14	6 17 08	7 35 40	4 33 47	5 48 43	7 04 35	3
28	4 58 45	6 17 52	7 36 41	4 31 33	5 45 57	7 01 19	2
29	4 59 10	6 18 29	7 37 34	4 29 13	5 43 04	6 57 55	1
30	4 59 30	6 18 59	7 38 17	4 26 49	5 40 05	6 54 23	0
	Sign 9.			Sign 8.			

Add.

A TABLE of the Equations of the Moons Center.

Subtract.

Mean Anomaly	Signs 4. Least Exc 43619	Signs 4. Middle. 55237	Signs 4. Greatest. 66854	Signs 5. Least Exc 43619	Signs 5. Middle. 55237	Signs 5. Greatest. 66854	Mean Anomaly
	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	
0	4 26 49	5 40 05	6 54 23	2 37 10	3 21 48	4 07 29	30
1	4 24 19	5 37 00	6 50 42	2 32 27	3 15 48	4 00 10	29
2	4 21 43	5 33 46	6 46 52	2 27 42	3 09 44	3 52 45	28
3	4 19 01	5 30 25	6 42 54	2 22 54	3 03 36	3 45 14	27
4	4 16 14	5 26 57	6 38 48	2 18 03	2 57 24	3 37 39	26
5	4 13 22	5 23 24	6 34 34	2 13 09	2 51 06	3 29 59	25
6	4 10 25	5 19 43	6 30 11	2 08 13	2 44 [illegible]	3 22 14	24
7	4 07 24	5 15 58	6 25 40	2 03 14	2 38 [illegible]	[illegible] 14 24	23
8	4 04 18	5 12 06	6 21 01	1 58 12	2 31 55	[illegible] 30	22
9	4 01 08	5 08 07	6 16 14	1 53 07	2 25 24	2 [illegible]	21
10	3 57 53	5 04 00	6 11 20	[illegible] 48 01	2 18 50	2 50 [illegible]	20
11	3 54 32	4 59 48	6 06 16	1 42 52	2 12 13	2 42 23	19
12	3 51 07	4 55 30	6 01 06	1 37 41	2 05 32	2 34 [illegible]	18
13	3 47 38	4 51 06	5 55 49	1 32 27	1 58 49	2 25 58	17
14	3 4[illegible] 04	4 46 36	5 50 21	1 27 11	1 52 05	2 17 41	16
15	3 40 27	4 42 00	5 44 48	1 21 54	1 45 17	2 09 21	15
16	3 36 43	4 37 17	5 39 06	1 16 35	1 38 26	2 00 [illegible]	14
17	3 32 55	4 32 27	5 33 17	1 11 14	1 31 33	1 52 3[illegible]	13
18	3 29 02	4 27 32	5 27 22	1 05 55	1 24 38	1 44 01	12
19	3 25 05	4 22 33	5 21 19	1 00 27	1 17 42	1 35 29	11
20	3 21 04	4 17 28	5 15 09	0 55 02	1 10 44	1 26 55	10
21	3 16 59	4 12 17	5 08 52	0 49 34	1 03 43	1 18 19	9
22	3 12 48	4 07 01	5 02 28	0 44 07	0 56 42	1 09 42	8
23	3 08 34	4 01 40	4 55 58	0 38 37	0 49 30	1 01 03	7
24	3 04 16	3 56 13	4 49 21	0 33 08	0 42 36	0 52 22	6
25	2 59 53	3 50 40	4 42 38	0 27 38	0 35 30	0 43 40	5
26	2 55 27	3 45 03	4 35 48	0 22 08	0 28 25	0 34 57	4
27	2 50 58	3 39 21	4 28 52	0 16 37	0 21 19	0 26 13	3
28	2 46 26	3 33 34	4 21 49	0 11 04	0 14 13	0 17 29	2
29	2 41 50	3 27 43	4 14 41	0 05 32	0 07 07	0 08 45	1
30	2 37 10	3 21 48	4 07 29	0 00 00	0 00 00	0 00 00	0
	Signs 7			Signs 6			

Add.

O

A TABLE *of the Variation.*

	Add.						
	Sign 0 6		*Sign* 1 7		*Sign* 2 8		
	′	″	′	″	′	″	
0	00	00	32	54	32	54	30
1	01	20	33	33	32	13	29
2	02	39	34	09	31	30	28
3	03	59	34	42	30	45	27
4	05	18	35	13	29	57	26
5	06	36	35	42	29	07	25
6	07	54	36	09	28	14	24
7	09	11	36	32	27	20	23
8	10	28	36	52	26	24	22
9	11	44	37	10	25	26	21
10	13	00	37	25	24	25	20
11	14	14	37	38	23	23	19
12	15	27	37	48	22	20	18
13	16	40	37	55	21	15	17
14	17	51	37	59	20	08	16
15	19	00	38	00	19	00	15
16	20	08	37	59	17	51	14
17	21	15	37	55	16	40	13
18	22	20	37	48	15	27	12
19	23	23	37	38	14	14	11
20	24	25	37	25	13	00	10
21	25	26	37	10	11	44	9
22	26	24	36	52	10	28	8
23	27	20	36	32	09	11	7
24	28	14	36	09	07	54	6
25	29	07	35	42	06	36	5
26	29	57	35	13	05	18	4
27	30	45	34	42	03	59	3
28	31	30	34	09	02	39	2
29	32	13	33	33	01	20	1
30	32	54	32	54	00	00	0
	Sign 11 5		*Sign* 10 4		*Sign* 9 3		
	Subtract.						

A Table *of the Equati. of the Node, and Inclinations of the Limit above* 5 *Deg.*

Equation of the ☊ Add.

☉ a ☊ dist.	*Signs* 0 6					*Signs* 1 7					*Signs* 2 8					☉ a ☊ dist.
	Equati. ☊			Inc.Lim		Equati. ☊			Inc.Lim		Equati. ☊			Inc.Lim		
	°	′	″	′	″	°	′	″	′	″	°	′	″	′	″	
0	0	00	00	18	00	1	25	12	13	30	1	26	50	04	30	30
1	0	03	28	18	00	1	27	00	13	14	1	25	01	04	14	29
2	0	06	56	17	59	1	28	37	12	57	1	23	06	03	59	28
3	0	10	23	17	59	1	30	04	12	40	1	21	06	03	43	27
4	0	13	49	17	55	1	31	22	12	23	1	19	03	03	28	26
5	0	17	11	17	52	1	32	30	12	05	1	16	56	03	13	25
6	0	20	31	17	48	1	33	34	11	47	1	14	44	02	59	24
7	0	23	48	17	43	1	34	34	11	29	1	12	26	02	45	23
8	0	27	02	17	38	1	35	31	11	11	1	10	02	02	32	22
9	0	30	13	17	34	1	36	25	10	53	1	07	31	02	19	21
10	0	33	22	17	28	1	37	15	10	34	1	04	53	02	06	20
11	0	36	29	17	21	1	37	59	10	14	1	02	09	01	54	19
12	0	39	34	17	13	1	38	37	09	55	0	59	19	01	43	18
13	0	42	37	17	05	1	39	09	09	37	0	56	23	01	32	17
14	0	45	38	16	57	1	39	33	09	18	0	53	21	01	22	16
15	0	48	37	16	48	1	39	46	09	00	0	50	15	01	12	15
16	0	51	33	16	38	1	39	34	08	42	0	47	06	01	03	14
17	0	54	27	16	28	1	39	11	08	23	0	43	56	00	55	13
18	0	57	17	16	17	1	38	41	08	05	0	40	44	00	47	12
19	1	00	06	16	06	1	38	05	07	46	0	37	29	00	39	11
20	1	02	51	15	54	1	37	23	07	26	0	34	12	00	32	10
21	1	05	31	15	41	1	36	34	07	07	0	30	53	00	26	9
22	1	08	04	15	28	1	35	46	06	49	0	27	32	00	22	8
23	1	10	29	15	15	1	34	56	06	31	0	24	09	00	17	7
24	1	12	48	15	01	1	34	03	06	13	0	20	44	00	12	6
25	1	15	01	14	47	1	33	06	05	55	0	17	18	00	08	5
26	1	17	08	14	32	1	32	05	05	37	0	13	51	00	05	4
27	1	19	12	14	17	1	31	00	05	20	0	10	24	00	03	3
28	1	21	14	14	01	1	29	47	05	03	0	06	57	00	01	2
29	1	23	14	13	46	1	28	24	04	46	0	03	29	00	00	1
30	1	25	12	13	30	1	26	50	04	30	0	00	00	00	00	0
	Signs 5 11					*Signs* 4 10					*Signs* 3 9					

Equation of the Node Subtract.

A TABLE *of the Moons simple Latitude, to the least Inclination of her Oabit* 5 *Degrees, with the parts to be added when 'tis* 5°18'.

Argu. of Lat.	Sign 0 Nor. 6 Sou. Ds Latitude.			Increm. or parts to be added.		Sign 1 Nor. 7 Sou. Ds Latitude.			Increm. or parts to be added.		Sign 2 Nor. 8 Sou. Ds Latitude.			Increm. or parts to be added.		Argu. of Lat.
	°	'	"	'	"	°	'	"	'	"	°	'	"	'	"	
0	0	00	00	0	00	2	29	51	9	00	4	19	44	15	36	30
1	0	05	14	0	19	2	34	22	9	16	4	22	18	15	45	29
2	0	10	28	0	37	2	38	50	9	32	4	24	49	15	54	28
3	0	15	42	0	56	2	43	15	9	48	4	27	14	16	02	27
4	0	20	55	1	15	2	47	37	10	03	4	29	34	16	11	26
5	0	26	08	1	34	2	51	56	10	19	4	31	50	16	19	25
6	0	31	20	1	53	2	56	11	10	34	4	34	00	16	27	24
7	0	36	32	2	11	3	00	24	10	49	4	36	06	16	34	23
8	0	41	43	2	30	3	04	33	11	04	4	38	06	16	42	22
9	0	46	53	2	49	3	08	39	11	19	4	40	02	16	49	21
10	0	52	02	3	08	3	12	42	11	34	4	41	52	16	55	20
11	0	57	10	3	26	3	16	41	11	48	4	43	37	17	01	19
12	1	02	18	3	45	3	20	36	12	02	4	45	17	17	07	18
13	1	07	24	4	03	3	24	38	12	16	4	46	52	17	12	17
14	1	12	29	4	21	3	28	16	12	30	4	48	21	17	18	16
15	1	17	33	4	39	3	32	00	12	44	4	49	45	17	23	15
16	1	22	36	4	57	3	35	40	12	56	4	51	04	17	28	14
17	1	27	37	5	15	3	39	17	13	09	4	52	18	17	33	13
18	1	32	36	5	33	3	42	49	13	22	4	53	26	17	37	12
19	1	37	34	5	51	3	46	17	13	35	4	54	28	17	40	11
20	1	42	29	6	09	3	49	42	13	47	4	55	26	17	44	10
21	1	47	23	6	27	3	53	02	13	59	4	56	18	17	47	9
22	1	52	16	6	45	3	56	17	14	11	4	57	04	17	50	8
23	1	57	06	7	02	3	59	29	14	23	4	57	45	17	52	7
24	2	01	54	7	19	4	02	36	14	34	4	58	21	17	54	6
25	2	06	39	7	36	4	05	39	14	45	4	58	51	17	56	5
26	2	11	23	7	53	4	08	37	14	56	4	59	16	17	58	4
27	2	16	04	8	09	4	11	30	15	06	4	59	35	17	59	3
28	2	20	42	8	26	4	14	19	15	17	4	59	49	17	59	2
29	2	25	18	8	43	4	17	04	15	26	4	59	57	18	00	1
30	2	29	51	9	00	4	19	44	15	36	5	00	00	18	00	0
	Sign 5 Nor. 11 Sou.					Sign 4 Nor. 10 Sou.					Sign 3 Nor. 9 Sou.					

A TABLE *of the Reduction when the Inclination of the Orbit is* 5 *Degrees, with the excess when it is* 5°18'.

Arg. of Lati.	Sign 0 6 Sub. Reduction		Excess.	Sign 1 7 Sub. Reduction		Excess.	Sign 2 8 Sub. Reduction		Excess.	Arg. of Lati.
	'	"	"	'	"	"	'	"	"	
0	0	00	02	5	40	42	5	41	42	30
1	0	14	02	5	47	43	5	34	41	29
2	0	27	04	5	53	44	5	26	40	28
3	0	41	06	5	59	45	5	18	39	27
4	0	55	08	6	04	46	5	10	38	26
5	1	08	09	6	09	46	5	02	37	25
6	1	22	11	6	14	46	4	53	36	24
7	1	35	12	6	18	47	4	43	35	23
8	1	48	13	6	21	47	4	34	34	22
9	2	01	15	6	24	47	4	23	33	21
10	2	14	17	6	27	48	4	13	31	20
11	2	27	19	6	29	48	4	02	30	19
12	2	40	20	6	31	48	3	51	29	18
13	2	52	22	6	32	48	3	40	28	17
14	3	04	23	6	33	49	3	29	26	16
15	3	16	24	6	33	49	3	17	24	15
16	3	28	26	6	33	49	3	05	23	14
17	3	40	28	6	32	49	2	53	22	13
18	3	51	29	6	31	49	2	40	20	12
19	4	02	30	6	29	48	2	28	19	11
20	4	12	31	6	27	48	2	15	17	10
21	4	23	33	6	25	47	2	02	15	9
22	4	33	34	6	22	47	1	49	13	8
23	4	44	35	6	18	47	1	35	12	7
24	4	52	36	6	14	46	1	22	11	6
25	4	01	37	6	10	46	1	08	9	5
26	5	09	38	6	05	46	0	55	8	4
27	5	18	39	6	00	45	0	41	6	3
28	5	26	40	5	54	44	0	27	4	2
29	5	33	41	5	47	43	0	14	2	1
30	5	40	42	5	41	42	0	00	0	0
	Sign 5 11			Sign 4 10			Sign 9 3			
Add.										

A Table *of the Moons true horary Motion in Eclipses, her horizontal Semidiameters, and Parallaxes, under her least and greatest Excentricities, with the Suns true hourly Motions and Semidiameters.*

Mean Anomaly.	Earths true hourly Moti.	Suns Semidiameter.	Moons true hourly Moti. Excentricity. 4362	6685	Moons horizontal Paral. Excentricity. 4362	6685	Moons horizontal Semidi. Excentricity. 4362	6685	Mean Anomaly.
s °	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	s °
0 00	2 23	15 50	30 51	29 30	55 35	54 23	15 04	14 45	12 00
06	2 23	15 50	30 52	29 31	55 35	54 23	15 05	14 45	24
12	2 23	15 50	30 55	29 33	55 38	54 26	15 05	14 46	18
18	2 23	15 50	30 59	29 39	55 43	54 31	15 06	14 47	12
24	2 23	15 51	31 03	29 47	55 48	54 38	15 08	14 49	06
1 00	2 23	15 52	31 10	29 57	55 54	54 47	15 10	14 52	11 00
06	2 24	15 53	31 19	30 09	56 01	54 58	15 12	14 55	24
12	2 24	15 54	31 29	30 22	56 09	55 11	15 14	14 58	18
18	2 24	15 55	31 40	30 37	56 19	55 25	15 16	15 02	12
24	2 25	15 56	31 52	30 55	56 30	55 41	15 19	15 06	06
2 00	2 25	15 58	32 06	31 15	56 42	55 58	15 23	15 11	10 00
06	2 26	15 59	32 21	31 36	56 56	56 17	15 27	15 16	24
12	2 26	16 01	32 36	31 59	57 10	56 37	15 30	15 21	18
18	2 27	16 02	32 54	32 24	57 25	56 59	15 34	15 27	12
24	2 27	16 04	33 11	32 50	57 39	57 22	15 38	15 34	06
3 00	2 28	16 06	33 29	33 18	57 54	57 45	15 42	15 40	9 00
06	2 28	16 08	33 47	33 47	58 10	58 10	15 47	15 46	24
12	2 29	16 09	34 07	34 15	58 27	58 35	15 51	15 53	18
18	2 29	16 11	34 26	34 43	58 43	59 01	15 55	16 01	12
24	2 30	16 13	34 45	35 12	58 58	59 25	16 00	16 07	06
4 00	2 30	16 14	35 03	35 42	59 13	59 48	16 04	16 14	8 00
06	2 31	16 15	35 20	36 10	59 28	60 12	16 08	16 20	24
12	2 31	16 17	35 36	36 36	59 43	60 35	16 12	16 26	18
18	2 32	16 19	35 51	37 01	59 56	60 56	16 16	16 32	12
24	2 32	16 20	36 05	37 24	60 07	61 14	16 19	16 37	06
5 00	2 32	16 21	36 17	37 45	60 16	61 30	16 21	16 41	7 00
06	2 33	16 21	36 27	38 02	60 24	61 44	16 23	16 45	24
12	2 33	16 22	36 34	38 15	60 30	61 55	16 25	16 48	18
18	2 33	16 22	36 39	38 25	60 35	62 03	16 26	16 50	12
24	2 33	16 23	36 43	38 31	60 38	62 08	16 27	16 51	06
6 00	2 33	16 23½	36 44	38 32	60 39	62 10	16 27	16 52	6 00

A Table *of the Angle which the true Motion of the Moon from the Sun, makes with the Ecliptick in the ☌s and ☍s.*

Arg. of Latitu.	The true hourly Motion of the Moon from the Sun. 27′	28′	29′	30	31′	32′	33′	34′	35′	36′	Arg. of Latitu.
Sig. 0 / Sig. 6	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	Sig. 5 / Sig. 11
gr. 0	5 46	5 45	5 44	5 43	5 42	5 41	5 40	5 39	5 38	5 37	gr. 30
1	5 46	5 45	5 44	5 43	5 42	5 41	5 40	5 39	5 38	5 37	29
2	5 46	5 45	5 44	5 43	5 42	5 41	5 40	5 39	5 38	5 37	28
3	5 46	5 45	5 44	5 43	5 42	5 41	5 40	5 39	5 38	5 37	27
4	5 45	5 44	5 43	5 42	5 41	5 40	5 39	5 3	5 37	5 36	26
5	5 45	5 44	5 43	5 42	5 41	5 40	5 3	5 38	5 37	5 36	25
6	5 44	5 43	5 42	5 41	5 40	5 39	5 38	5 37	5 36	5 35	24
7	5 44	5 43	5 42	5 41	5 40	5 39	5 3	5 37	5 36	5 35	23
8	5 43	5 42	5 41	5 40	5 39	5 38	5 37	5 36	5 35	5 34	22
9	5 42	5 41	5 40	5 39	5 38	5 37	5 36	5 35	5 34	5 33	21
10	5 41	5 40	5 39	5 38	5 37	5 36	5 35	5 34	5 33	5 32	20
11	5 40	5 39	5 38	5 37	5 36	5 35	5 34	5 33	5 32	5 31	19
12	5 39	5 38	5 37	5 36	5 35	5 34	5 33	5 32	5 31	5 30	18

TABLE XIX.

A Table *of the time of Reduction, or betwixt the true ☌ or ☍ of the Luminaries, and the nearest Approach of their Centers.*

Arg. of Latitu.	Subtract from the time of the true ☌ or ☍ in the Orbit. The true hourly Motion of the Moon from the Sun. 27′	28′	29′	30′	31′	32′	33′	34′	35′	36′	Arg. of Latitu.
Sig. 0 / Sig. 6	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Sig. 5 / Sig. 11
gr. 0	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	0 00	gr. 30
1	0 35	0 34	0 33	0 31	0 30	0 29	0 28	0 27	0 26	0 26	29
2	1 10	1 07	1 05	1 03	1 00	0 58	0 56	0 55	0 53	0 51	28
3	2 45	1 41	1 37	1 34	1 30	1 27	1 25	1 22	1 19	1 17	27
4	2 20	2 15	2 10	2 05	2 00	1 56	1 53	1 49	1 45	1 42	26
5	2 55	2 48	2 42	2 36	2 30	2 25	2 21	2 16	2 12	2 08	25
6	3 29	3 21	3 14	3 07	3 00	2 54	2 48	2 43	3 38	2 33	24
7	4 04	3 54	3 46	3 38	3 30	3 23	3 16	3 10	3 04	2 58	23
8	4 38	4 27	4 17	4 08	3 59	3 51	3 43	3 36	3 09	3 23	22
9	5 11	4 59	4 48	4 38	4 28	4 19	4 10	4 02	3 54	3 47	21
10	5 44	5 31	5 19	5 07	4 56	4 46	4 37	4 28	4 19	4 21	20
11	6 17	6 03	5 49	5 37	5 25	5 14	5 03	4 53	4 44	4 35	19
12	6 50	6 34	6 19	6 06	5 53	5 41	5 29	5 19	5 09	4 59	18

Add to the time of the true ☌ or ☍ of the Sun and Moon in her Orbit.

A TABLE *of the Mean Motions of the Moon from the Sun.*

Current Y. of Christ.	The Mean Motion of the ☽ from the ☉ s	°	'	"
1	06	23	31	29
1501	04	10	26	36
1581	10	04	05	33
1601	02	17	30	17
1621	07	00	55	01
1641	11	14	19	45
1661	03	27	44	29
1681	08	11	09	13
1701	00	24	33	57
1721	05	07	58	41
1741	09	21	23	25
1761	02	04	48	09
1781	06	18	12	54
1801	11	01	37	38
1901	09	08	41	18
2001	07	15	44	59

Comple. Julian Y.	Motion of the ☽ from the ☉. s	°	'	"
20	04	13	24	44
40	08	26	49	28
60	01	10	14	12
80	05	23	38	56
100	10	07	03	40
200	08	14	07	21
300	06	21	11	01
400	04	28	14	42
500	03	05	18	22
600	01	12	22	03
700	11	19	25	43
800	09	26	29	24
900	08	03	33	04
1000	06	10	36	45
2000	00	21	13	30
3000	07	01	50	15
4000	01	12	27	00
5000	07	23	03	45

Compleat Years.	The Mean Motion of the ☽ from the ☉. s	°	'	"
1	04	09	37	23
2	08	19	14	45
3	00	28	52	07
4	05	20	40	57
5	10	00	18	20
6	02	09	55	42
7	06	19	33	04
8	11	11	21	54
9	03	20	59	17
10	08	00	36	39
11	00	10	14	01
12	05	02	02	50
13	09	11	40	13
14	01	21	17	35
15	06	00	54	57
16	10	22	43	47
17	03	02	21	10
18	07	11	58	32
19	11	21	35	54
20	04	13	24	44

Months.	Motion of the ☽ from the ☉. s	°	'	"
Jan	00	00	00	00
Feb.	00	17	54	47
Mar.	11	29	15	14
Apr.	00	17	10	02
May.	00	22	53	22
June.	01	10	48	10
July.	01	16	31	32
Aug.	02	04	26	18
Sep.	02	21	21	06
Octo.	02	28	04	27
Nov.	03	15	59	14
Dec.	03	21	42	34

Days.	The Mean Motion of the ☽ from the ☉. s	°	'	"
1	00	12	11	27
2	01	24	22	53
3	01	06	34	20
4	01	18	45	47
5	02	00	57	13
6	02	13	08	40
7	02	25	20	07
8	03	07	31	33
9	03	19	43	00
10	04	01	54	27
11	04	14	05	53
12	04	26	17	20
13	05	08	28	47
14	05	20	40	13
15	06	02	51	40
16	06	15	03	07
17	06	27	14	33
18	07	09	26	00
19	07	21	37	27
20	08	03	48	53
21	08	16	00	20
22	08	28	11	47
23	09	10	23	13
24	09	22	34	40
25	10	04	46	07
26	10	16	57	33
27	10	29	09	00
28	11	11	20	27
29	11	23	31	53
30	00	05	43	20
31	00	17	54	47
32	01	00	06	13

H. / ' / "	M.Motion ° / ' / "	' / " / '''	" / ''' / ''''	H. / ' / "	M.Motion ° / ' / "	' / " / '''	" / ''' / ''''
1	00	30	29	31	15	44	47
2	01	00	57	32	16	15	16
3	01	31	26	33	16	45	44
4	02	01	54	34	17	16	13
5	02	32	23	35	17	46	42
6	03	02	54	36	18	17	10
7	03	33	20	37	18	47	39
8	04	03	49	38	19	18	07
9	04	34	18	39	19	48	36
10	05	04	46	40	20	19	05
11	[illegible]	35	15	41	20	49	33
12	06	05	43	42	21	20	02
13	06	36	12	43	21	50	31
14	07	06	41	44	22	20	59
15	[illegible]	37	09	45	22	51	28
16	[illegible]	07	38	46	23	21	56
17	08	38	00	47	23	52	25
18	09	08	35	48	24	22	54
19	09	39	04	49	24	53	22
20	10	09	32	50	25	23	51
21	10	40	[illegible]	51	25	54	19
22	11	10	30	52	26	24	48
23	11	40	58	53	26	55	17
24	12	11	27	54	27	25	45
25	12	41	55	55	27	56	13
26	13	12	24	56	28	26	43
27	13	42	53	57	28	57	11
28	14	13	21	58	29	27	40
29	14	43	50	59	29	58	08
30	15	14	19	60	30	28	37

In the Leap-year add a Day to the Time, and a Days Motion to the Motion Collected.

ARITHMETICK

IN

SPECIES,

OR,

ALGEBRA.

LIB. IV.

Printed at LONDON, by *Anne Godbid*, and *John Playford*, 1680.

A

ARITHMETICK in SPECIES,

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Teacheth an Universal Method of Resolving all difficult Questions, both in Arithmetick *and* Geometry.

CHAP. I.

§ 1. *Notation.*

1. DEsign all Quantities with Letters, but when any Quantity is taken more than once, prefix its Number, as $5a$, $7c$, &c. stands for a taken five times, c seven times, or seven times c, &c. And these prefixed Quantities, whether Numbers, or Letters, denoting some known Quantities, are called *Coefficients*, or *Fellow-factors*.

2. If

2. If a Letter have no prefixt Number or Coefficient, then such a Quantity stands for it self once, and is understood to have 1 for its Prefix or Coefficient.

3. All Quantities expressed by Numbers (as in Vulgar Arithmetick) not having any Letter or Character annexed to them, are called *Absolute Numbers.*

4. A Root and the Powers resulting from the Root are called *Cossick Quantities*, or *Powers.*

5. The *Indices* are the Terms of an Arithmetical Progression proceeding in the Natural Order of Numbers, as 1, 2, 3, *&c.* as the *Cossicks* go in a Geometrical, from a Root to a Square, and from a Square to a Cube, *&c.*

6. The Sum of any two Exponents or Indices, is an *Index* shewing what Power will be produced by the Multiplication of those Powers one in another, which answer to the Indices that were added together.

7. The *Difference* of any two Indices sheweth what Power will be produced by the Division of those Powers one by another, which answer to the Indices that were subtracted.

8. All *Magnitudes* that are under any Power are called *Parodical* to the Power.

9. For distinction, note all Schemes with the Capital or great Letters, and work all *Algebraick* Operations with the small.

10. Numbers prefixt to any Quantity shew how often it's to be taken, but set at the head of a Quantity, then shew a Power or Degree of that Quantity.

11. The Sign still belongs to the Quantity following, or to the right hand of it. If a Quantity have no Sign before it, 'tis understood to have the Sign +.

12. Quantities expressed by Letters are either *Simple* or *Compound.*

Simple Quantities are such as are expressed either by a single Letter, or by more joyned together like Letters in a Word, as a, ba, *&c.*

Compound Quantities consist of two or more simple Quantities joyned together with Signs, as $b + a$, *&c.*

Every one of these four Signs +, —, ∽, ×, may sometimes have reference to the *Compound* Quantity that followeth the Sign, and hath a Line drawn over every Member of it, as $y - \overline{r \backsim a}$, $b - \overline{y + x}$, *&c.*

13. Like Quantities or *Species* are such which are expressed by the same Letters under the same Power, as a & a, b & b, c^2 & c^2, *&c.*

14. Unlike Quantities are those which are expressed by different Letters, or by the same Letters under different Powers, as a & b, b^3 & b^2, *&c.*

The TABLE.

7	6	5	4	3	2	1	0	$\bar{1}$	$\bar{2}$	$\bar{3}$	$\bar{4}$	$\bar{5}$	$\bar{6}$	$\bar{7}$	$\bar{8}$	*Indices.*
128	64	32	16	8	4	2	0	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{64}$	$\frac{1}{128}$		*Coss. Pow.*
	QC	*S*	*QQ*	*C*	*Q*	℞	0	℞	$\overline{Q}$	$\overline{C}$	$\overline{QQ}$	$\overline{S}$	$\overline{QC}$			*Ought.*
	Acc	*Aqc*	*Aqq*	*Ac*	*Aq*	*A*	0	*A*	*Aq*	*Ac*	*Aqq*	*Aqc*	*Acc*			*Har.*
		&c.	*aaaa*	*aaa*	*aa*	*a*	0	*a*	*aa*	*aaa*	&c.					
a^7	a^6	a^5	a^4	a^3	a^2	a	0	a	a^2	a^3	a^4	a^5	a^6	a^7		*Des Char.*
2 Surfolids.	Cubick Cubes.	Surfolid, or Square of Cubes.	Biquadrat.	Cube.	Square.	Root.	Absol. Numbers.	Root.	Square.	Cube.	Biquadrat.	Surfolid.	Cubick Cube.			

The Signs for the more short and quick expressing Words and Operations in Species.

+	The Sign of Affirmation or Addition.	::	The Sign of Disjunct, Proportion, or Symbol of the Golden Rule.
—	The Sign of Negation or Subtraction.	∺	Continual Proportion.
×	The Sign of Multiplication.	=	The Sign of Equality.
◎	The Sign of Involution.	⊏	Greater than, but some use >.
C□	The Sign of Completion.	⊐	Lesser than, but some use <.
÷	The Sign of Division.	◎	Evolution, but some use ω.
∽	Signifieth the Difference of two Quantities is to be taken, when it's not known which is the greater.	∗	The defect of a Degree.
		√	The Radical Sign, or Sign of Irrationality.
		√:	The Sign of an Universal Root.

§ 2. *Addition.*

WHen the *Quantities* to be added, or *Species* by which they are expressed, are alike, and have like Signs; first add the prefixed Numbers together, and set their common Sign to the left hand thereof. But if the Signs be unlike, subtract the lesser prefixed Number from the greater,

and to the left hand of the Remainder, prefix the Sign of the Letter wherein the Excefs lieth: then to the right hand of that Sum or Difference annex the Letter or Letters, fo is this new Quantity the Sum. But when the Quantities to be added be unlike, write them down one after another in a Rank with their Signs.

	1	$2a$	a	$-a$	$-a$	$5b$	a	3	-5	b^3	$-7bye$
	2	$-2a$	a	$3a$	$-a$	$-3b$	b	-2	-7	$5b^3$	$2bye$
$1+2$	3	0	$2a$	$2a$	$-2a$	$2b$	$b+a$	1	-12	$6b^3$	$-5bye$

	1	$a+b$	$a-b$	$a-b$	$8y-xc$	$n-7n^2$
	2	$a+b$	$a-b$	$a+b$	$3y+5xe+2a^2$	$b+5n^3$
$1+2$	3	$2a+2b$	$2a-2b$	$2a$	$11y+4xc+2a^2$	$b+n+5n^3-7n^2$

§ 3. *Subtraction.*

First change, or imagin to be changed, all the Signs of the Quantities to be fubtracted; then add or collect into one Sum by Addition all the Quantities, as well thofe from which the fubduction was to be made, as the other that were to be fubducted; and that Collection or Sum is the Remains or Difference fought.

	1	$4a$	$5a$	a	5	-5	-9	a	$5a$	$4a$	b^2
	2	a	$-2a$	b	-3	3	-7	a	$2a$	$-3a$	b^3
$1-2$	3	$3a$	$7a$	$a-b$	8	-8	-2	0	$3a$	$7a$	b^2-b^3
$2+3$	4	$4a$	$5a$	a	5	-5	-9	a	$5a$	$4a$	b^2

	1	$a+b$	$a-b$	$a+b$	$a-b$	$5a^2-7+3y$	$5e+8b$
	2	$a-b$	$a-b$	$a+b$	$a+b$	$3a^2+9-2x$	$6e+b$
$1-2$	3	$2b$	0	0	$-2b$	$2a^2-16+3y+2x$	$-1e+7b$
$2+3$	4	$a+b$	$a-b$	$a+b$	$a-b$	$5a^2-7+3y$	$5e+8b$

§ 4. *Multiplication.*

First Multiply the prefixt Numbers together, and connex or joyn the Product and both or all the Letters to be multiplied without any Signs between them; and note, that if the Signs of the Quantities to be multiplied be alike, then the fign of Affirmation is to be prefixed to the Product; But if they be unlike, then the Sign of Negation.

Sometimes in long Compounds, and fome other particular Cafes, it's neceffary to omit the Operation, and joyn or fet together the Quantities with the Sign × or *Into* between them, drawing a conjugating Line over each compound Quantity, as $\overline{a+b} \times \overline{r-l}$.

	1	a	$3a$	ae	$a-e$	$b+1$	a	a^2	aa
	2	e	$2e$	ae	b	a	a	a	aa
1×2	3	ae	$6ae$	a^2e^2	$ba-be$	$ba+a$	a^2	a^3	$aaaa$

	4	$-5r^2$	75	-9	n^5	$a-b$	$7le$	$a+e+n$
	5	$-3y$	-3	-7	n^3	a	$-5ry$	z
4×5	6	$15r^2y$	-225	63	n^8	a^2-ba	$-35lery$	$az+ez+nz.$

	7	$7e^5$	$ll+2ma$
	8	$-3a^3$	$-5b$
7×8	9	$-21e^5a^3$	$-5llb-10mab$

	10	$a+e$	$a+e$	$a-e$
	11	$a-e$	$a+e$	$a-e$
		$-ae-e^2$	$ae+e^2$	$-ae+e^2$
		a^2+ae	a^2-ae	a^2+ae
10×11		a^2-e^2	$a^2+2ae+e^2$	$a^2-2ae+e^2$

§ 3 $a - e$ Root.
$a - e$

$-ae + e^2$
$a^2 - ae$

$a^2 - 2ae + e^2$ Square.
$a - e$

$-a^2e + 2ae^2 - e^3$
$a^3 - 2a^2e + ae^2$

$a^3 - 3a^2e + 3ae^2 - e^3$ Cube.

§ 3 $a + e$ Root.
$a + e$

$ae + e^2$
$a^2 + ae$

$a^2 + 2ae + e^2$ Square.
$a + e$

$a^2e + 2ae^2 + e^3$
$a^3 + 2a^2e + ae^2$

$a^3 + 3a^2e + 3ae^2 + e^3$ Cube.

Hence may be noted, that the Powers of a Residual Root differ from the like Powers from a Binomial only in Sign, and that in each Power of a Residual the Signs prefixt to the parts of the Power are alternately + and —, *viz.* the first +, the second — *&c.* Farther, that all the parts or Members of any Power raised from a Binomial or Residual Root, taken together without unity are in continual Proportion.

Again we may note, that admitting *a* and *e* to be the two parts of a Line or Number, the Sum of the Squares of the said two parts, more the double Rectangle, is equal to the Square of the whole Number; But the Sum of the Squares of the said parts, less the double Rectangle, equals the Square of the Difference of those parts.

The Difference of the Squares of the said parts equals the Product of their Sum and Difference. The square of their Difference taken from the Sum of their Squares, the Remainder shall be the double Rectangle; or thus, the double Rectangle, more the Square of the Difference, is equal to the Sum of their Squares. The Square of the Difference, less the Quadruple Rectangle, is equal to the Square of their Sum.

The Product of the Difference and Sum added to twice the Rectangle more the double Square of the lesser, makes the Square of their Sum. The Square of the Sum, less the Difference of the Squares, equals the double Rectangle, more the double Square of the lesser Number.

The Square of the Sum, less the double Rectangle, equals the Sum of the Squares.

A Table

A Table of Powers *made by the former method of Multiplication, and may thereby be continued at pleasure.*

a	a^2	a^3	a^4	a^5	a^6
e	$2ae$	$3a^2e$	$4a^3e$	$5a^4e$	$6a^5e$
	e^2	$3ae^2$	$6a^2e^2$	$10a^3e^2$	$15a^4e^2$
		e^3	$4ae^3$	$10a^2e^3$	$20a^3e^3$
			e^4	$5ae^4$	$15a^2e^4$
				e^5	$6ae^5$
					e^6 &c.

The *Powers* of any Binomial or Residual Root may be thus raised without continual multiplication. Set down all the Parodical Degrees under the highest Power to each part of the Root, then joyn them together, prefixing the Unity as in this small Table, which is made and continued by Arithmetical Progression on either side in form of a Triangle, and adding up every two Numbers above for middle or Intermediats under.

a
2
3 3
4 6 4
5 10 10 5
6 15 20 15 6
7 21 35 35 21 7
8 28 56 70 56 28 8

§ 5. *The Composition or Genesis of* Powers *in Numbers from a Binomial Root.*

SEt the Numbers of the given Root somuch distant, that there may be room for the Rectangles; then take the first Number to the left-hand for *a*, and the next to it for *e*, and work according to the Table for that Power; setting down all the Parts in their due places, add them, and the Sum is the Power of them two Figures; then take the two left-hand Figures of the Root for *a*, and the next for *e*, and work according to the tenor of the Table, *&c.*

♋ 3.

3	7	
27	...	a^3
18	9..	$3a^2e$
4	41.	$3ae^2$
	343	e^3
The Cube 50	653	

♋ 4.

2	3	1	
16	....		a^4
9	6...		$+4a^3e$
2	16..		$6a^2e^2$
	216.		$4ae^3$
	81		e^4
27	9841	....	a^4
	1216	7...	$4a^3e$
	31	74..	$6a^2e^2$
		8.	$+4ae^3$
		1	e^4
28	1089	4481	The Biquad.

♋ 2.

2	3	Root.
4	..	a^2
1	2.	$2ae$
	9	e^2
5	29	The Square

♋ 3.

6	4	3	5	
216	...			a^3
43	2..			$3a^2e$
2	88.			$3ae^2$
	64			e^3
262	144	...		a^3
3	686	4..	...	$3a^2e$
	17	28.	...	$3ae^2$
		27		e^3
265	847	707	...	a^3
	620	173	5..	$3a^2e$
		482	25.	$3ae^2$
			125	e
266	468	362	875	The Cube desired.

§ 6. *Division.*

Division undoth that which Multiplication composeth or doth; Therefore take such a Quantity for the Quotient, as being multiplied by the Divisor, the Product may equal the Dividend; which is done by observing the order of Multiplication, and considering whether the Dividend be composed of the Divisor for one Factor; for then the other shall be the Quotient: And note, that if the Signs of the Divisor and Dividend be unlike, the Quotient will be negative; but if like, the Quotient will be affirmaitive. If the Dividend be not so composed, then set the Dividend over the Divisor in form of a Fraction.

$b)\,ba\,($

$b)\ ba\ (a$ $\quad 3a^2)\ 6a^3\ (2a$ $\quad a^3)\ a^7\ (a^4$ $\quad a)\ ae\ (e$

$a^2)\ da^3\ (da$ $\quad b)\ ay\ \left(\frac{ay}{b}\right.$ $\quad -3b)\ 9b\ (-3$ $\quad 2b-y)\ 3a\ \left(\frac{3a}{2b-y}\right.$

$a-e)\ ba-be\ (b$ $\quad c)\ bc+c\ (b+1$ $\quad e+y)\ e^3+e^2y\ (e^2$

$$\begin{array}{l} b)\ zb+ab\ (z+a \\ \quad zb \\ \hline \quad 0+ab \\ \qquad ab \\ \hline \qquad 0 \end{array} \qquad 5r^3)\ by-ry\ \left(\frac{by-ry}{5r^3}\right. \qquad \begin{array}{l} -5b^2)\ 5rb^2-5yb^2\ (-r+y \\ \quad 5rb^2 \\ \hline \quad 0-5yb^2 \\ \hline \qquad 0 \end{array}$$

$$\begin{array}{l} a-y)\ ba-by+ry-ar\ (b-r \\ \quad ba-by \\ \hline \quad 0+ry-ar \\ \qquad ry-ar \\ \hline \qquad 0 \end{array} \qquad \begin{array}{l} ry-r^2)\ r^2y^3+r^4y-2r^5\ (ry^2+r^3 \\ \quad r^2y-r^3y^2 \\ \hline \quad r^3y-r^3y-2r^5 \\ \quad r^4y-\quad -r^5 \\ \hline \quad r^3y-r^5 \end{array}$$

CHAP. II.

FRACTIONS.

§ 1. *Abbreviation.*

When an Integer is to be expressed Fraction-wise, give it an Unite for its Denominator.

1. IF the Numerator and Denominator be both Simple Quantities, strike out all the Letters that are alike, both in the Numerator, and Denominator, abbreviating the prefixt Numbers (if any) as in Vulgar Arithmetick.

Abr. $\frac{abr}{aby}$ fa. $\frac{r}{y}$ $\frac{abr}{ady}$ fa. $\frac{br}{dy}$ $\frac{byn}{ynr}$ fa. $\frac{b}{r}$

Abr. $\frac{36ee}{4be+16ze}$ fa. $\frac{9e}{b+4z}$ $\frac{12ab+8ay}{16az}$ fa. $\frac{3b+2y}{4z}$

2. If the Numerator and Denominator be Compound Quantities, find a Quantity which will divide both the Numerator and Denominator without leaving any Remains, by which Quantity abridge the Fraction given.

Abr. $\frac{an+bn}{a^2+2ba+b^2}$ fa. $a+b$ the common Divisor, by which the Fraction being abridged becomes $\frac{n}{a+b}$.

3. Re-

§ 2. *Reduction.*

1. TO Reduce an Integer to a Fraction of a given Denomination, multiply the Integer and given Denominator together, for a new Numerator, which being set over the Denominator, shall form a Fraction desired.

z reduced to the Denominator y. fa. $\frac{zy}{y}$.

$r+f$ reduced to the Denominator b is $\frac{br+bf}{b}$.

2. To find the smallest Quantity that can be divided by two or more given Quantities severally without a Remainder.

If the given Quantities be in their least Terms, multiply them together, and that Product is the Quantity that will answer the demand.

But if they be not in their least Terms, reduce them (by abbreviation) to their least Terms, and setting them Fraction-wise multiply cross, and that Product is the Quantity sought.

3. To Reduce Integers and Fractions to Improper Fractions, multiply the Integral Parts by the Denominator of the Fraction, and to the Sum add the Numerator, which Sum is the new Numerator.

$b+\frac{y}{a}$ makes $\frac{ba+y}{a}$.

4. To reduce an Improper Fraction to an Integer and Fraction, divide the Numerator by the Denominator; thus:

$\frac{be+cer}{e}$ makes $b+\frac{cer}{e}$.

5. To reduce Fractions of divers Denominations to one Denomination.

Multiply the Numerator of each Fraction into all the Denominators, except its own, so the Products made by that continual Multiplication shall be new Numerators, and multiply all the Denominators together for a new Denominator.

$\frac{ac}{b}$ and $\frac{br}{a}$ reduced, make $\frac{a^2c}{ba}$, $\frac{b^2r}{ba}$.

$\frac{e}{r}$, $\frac{y}{x}$, $\frac{2eg}{h}$ redu $\frac{exh}{rxh}$, $\frac{ryh}{rxh}$, $\frac{2rxeg}{rxh}$

§ 3. Addi-

§ 3. *Addition and Subtraction of Fractions.*

IF the Fractions be of one Denomination, add or ſubtract their Numerators, and ſet the Sum or Remains as a new Numerator over the Common Denominator; but if they be of divers Denominations, reduce them firſt to one Denomination, and then add or ſubtract them.

Add $\frac{lly}{r}$ to $\frac{sr}{t}$, reduced they are $\frac{tlly \quad sr^2}{tr}$, and the Sum $\frac{tlly+sr^2}{tr}$

Take $\frac{br-a}{f}$ from $\frac{r^3y}{2b}$, reduced they are $\frac{2b^2r-2ba}{2bf}$ $\frac{r^3yf}{2bf}$, and the Difference $\frac{r^3yf-2b^2r+2ba}{2bf}$.

§ 4. *Multiplication of Fractions.*

MUltiply the Numerators together for a new Numerator, and the Denominators for a new Denominator, which new Fraction ſhall be the Product.

Mult. a by $\frac{5}{a}$ Product $\frac{5a}{a}$. $\frac{5y^2}{c}$ by $\frac{r}{7d}$ Product $\frac{5y^2r}{7cd}$

Mult. $\frac{3b}{2y}$ by $\frac{fr}{ab}$ Product $\frac{3bfr}{2yba}$ or $\frac{3fr}{2ya}$.

§ 5. *Diviſion.*

MUltiply croſs-wiſe the Numerator of the Diviſor by the Denominator of the Dividend for a new Denominator, and the Numerator of the Dividend by the Denominator of the Diviſor for a new Numerator; but when the Fractions are of the ſame Denomination, divide the Numerators by each other, caſting away the Denominators.

$$\frac{b}{a}\Big)\ \frac{r}{a}\ \Big(\frac{r}{b} \qquad \frac{y}{2}\Big)\ \frac{5}{z}\ \Big(\frac{10}{yz} \qquad \frac{2}{3}\Big)\ \frac{r}{y}\ \Big(\frac{3r}{2y} \qquad 7\Big)\ \frac{r^2b}{a}\ \Big(\frac{r^2b}{7a}$$

$$\frac{ab}{y}\Big)\ 3zb\ \Big(\frac{3yzb}{ab} \qquad \frac{f^2-r}{5y}\Big)\ \frac{g^2b}{r-f}\ \Big(\frac{5yg^2b}{f^2r-r^2-f^3+fr}$$

CHAP.

CHAP. III.

Evolution, or Extraction of Roots of Simple Species.

DIvide the Index of the Quantity, out of which the Extraction is to be made, by the Index of the Power to be Extracted, and the Quotient is the Index of the Root; as to Extract the Square Root of a Quantity, divide the Index by 2; if the Cube Root, by 3, *&c.* and deal with the prefixt Numbers as in Vulgar Arithmetick. But if the Root cannot be Extracted, prefix to the Quantity out of which the Extraction was to be made, the $\surd$, with the Index of the Power before it, hence ariſeth Surds.

To extract a Root out of a Fraction, firſt Extract the Root of the Numerator, and then of the Denominator, which new Fraction is the Root deſired. But if the intended Root cannot be extracted out of either Numerator or Denominator, prefix the Radical Sign.

	1	a^4	$216c^3$	$36yy$	$81gg$	$8fff$	a^2b^2	$\frac{a^2b}{cc}$
1 ⊙ 2	2	a^2	$\surd 216c^3$	$6y$	$9g$	$2\surd 2fff$	ab	$\frac{a\surd b}{c}$
1 ⊙ 3	3	$\surd(3)a^4$	$6c$	$\surd(3)36y^2$	$3\surd(3)3g^2$	$2f$	$\surd(3)a^2b^2$	$\surd(3)\frac{a^2b}{cc}$
1 ⊙ 4	4	a	$\surd(4)216c^3$	$\surd 6y$	$3\surd g$	$\surd(4)8fff$	$\surd ab$	$\surd(4)\frac{a^2b}{cc}$

§ 1. The

§ 1. *The Analysis, or Extraction of Roots out of Numbers.*

DIstinguish the given Number with Points, according to the Number of Means or Rectangles, between the two Diagonal Powers in the Table. Then out of the Figures of the first Point, or first set of Figures towards the left hand, take the greatest Root of the kind to be Extracted that is in them, which Root call a, then a being rightly ordered according to the Table, makes a Divisor, by which divide, and the Quotient is the second Figure of the Root e; so a and e rightly composed according to the Table, produce the Sum to be subtracted, or *Gnomon.* Then to find another Figure of the Root, take the two Figures of the Root already found for a new Value of a, which composed according to the Table, make a new Divisor; by which divide, and the Quotient is a new Value of e; which a and e ordered according to the Table, make the *Gnomon,* or *Ablatitium,* which must be subtracted. Then take the three Figures of the Root already found, for a new Value of a, which compose into a Divisor, &c.

If the Number doth not divide off, but something remain, set so many Punctations of Cyphers for that kind, as shall be judged needful, and continue the Extraction therewith.

If the Numbers propounded be a Fraction or mixed Number, reduce it to a Decimal, and then Extract the Root thereof, as before.

☞ 2.

6	82	73	15	(2612
4				a^2
2	82			Resol.
	4 .			$2a$ Divisor.
2	4 .			$2ac$
	36			e^2
2	76			Ablat.
	6	73		Resol.
	5	2 .		$2a$ Divisor.
	5	2 .		$2ac$
		1		e^2
	5	21		Ablat.
	1	52	15	Resolv.
		52	2 .	Divisor.
	1	04	4 .	$2ac$
			4	e^2
	1	04	44	Ablat.
			..	

☞ 3.

15	625	(25
8		a^3
7	625	Resolvend.
1	2 . .	$3a^2$
	6 .	$3a$
1	26 .	Divisor.
6	0 . .	$3a^2e$
1	50 .	$3ae^2$
	125	e^3
7	625	Subducend.
	000	

☞ 4.

3	9525	6871	(141
1			a^4
2	9525		Resol.
	4 . . .		$4a^3$
	6 . .		$6a^2$
	4 .		$4a$
	4640		Divisor.
1	6 . . .		$4a^3e$
	96 . .		$6a^2e^2$
	256 .		$4ae^3$
	256		e^4
2	8416		Subducend.
	1109	6871	Resol.
	1097	6 . . .	$4a^3$
	11	76 . .	$6a^2$
		56 .	$4a$
	1109	416 .	Divisor.
	1097	6 . . .	$4a^3e$
	11	76 . .	$6a^2e^2$
		56 .	$4ae^3$
		1	e^3
	1109	4161	Subduc.
	. .	2710	Rem.

§ 2. *Surds.*

ALL Quantities that have not a Radical Sign prefixt are called Rational, whether they be Integers or Fractions; but if any Root be desired out of any Quantity, and cannot be Extracted perfectly, that Quantity is called Surd, and hath the Sign of the desired Root prefixt.

CHAP. IV.

EQUATION.

§ 1. *An Equation is a mutual comparing of equal Quantities, or Things.*

WHen a Queſtion is propounded, in the firſt place the meaning of it muſt be clearly comprehended; which that you may do, when any Arithmetical Queſtion (wherein Numbers are mixt or confounded with material things, as Men, Money, Time, *&c.*) is propounded, ſeparate the ſame from ſuch things, and ſee how it will ſtand, or be propounded in the pure conſideration of Numbers.

2. Then deſign, note, or expreſs all the Quantities in the Queſtion, as well unknown as known, with Letters; the known with great Letters, and the unknown with ſmall; or the known with the Letters in the firſt part of the Alphabet, and the unknown with thoſe of the Latter end, as *Y Z*, *&c.* forming them into Equations; (but when divers Quantities are granted to be equal, they may be expreſſed by the ſame Letter;) which Equations muſt be ordered, diſpoſed, and moulded, according to the import of the Problem or Queſtion, 'till all the unknown Quantities vaniſh but one.

3. And note, that (in a Queſtion ſo ſtated) if the unknown Symbols or Letters be more than the number of Equations, not mutually depending upon one another, the Queſtion is not fully limited, but is capable of innumerable Anſwers. A Problem hath a certain determinable number of Anſwers, when the Equations, no ways depending one upon another, are as many juſt as the Quantities unknown or ſought.

To preſcribe Rules which may hold in all caſes, for the taking off all the unknown Quantities but one, is a difficult, if not impoſſible, work; yet here ſhall be inſerted three Rules, which are ſo comprehenſive, that few

few Queſtions will fall without them, and thoſe that do, an Ingenious perſon will ſoon diſcover the way to proceed by their due intermixture.

Rule I.

VVHen the ſame Quantity is found in two ſeveral Equations, with equal prefixes, if their Signs be like ſubtract them, but if unlike add them.

Rule II.

VVHen the ſame Quantity is found in two ſeveral Equations, with unequal prefixes; multiply the firſt Equation by the prefix, to the ſaid Quantity in the ſecond Equation, and the ſecond Equation by the prefix to the ſaid Quantity in the firſt; then will the prefixes to the ſaid Quantity be the ſame in both Equations, and ſo fall under the firſt Rule, for farther clearing. Laſtly, if there be more ſuch Equations by repeating the former work; expell the ſame Quantity out of them alſo.

Rule III.

IF neither of the two Rules above will take place, by *Chap.* 4. § 2. following, bring the Quantity you firſt intended to baniſh to one ſide of the firſt Equation alone, making the Equation ſtand between it and the other; then in the place of that Quantity ſubſtitute its equal, through all the Equations, ſo ſhall they be cleared of that; afterwards bring by Tranſpoſition a ſecond Letter to ſtand alone on one ſide of one of the Equations as before, ſubſtituting the other ſide of that Equation every were, throughout all the other Equations, in the Room of this ſecond Letter to be taken away, ſo proceeding with the third, fourth *&c.* till all the unknown be taken away, ſave one.

Then for as much as every Problem when thus brought to one ſingle Equation, hath yet the known Quantities interwoven or mixed with that unknown; the next work will be to clear it of all ſuperfluous Quantities, and to ſeparate the known, from the unknown, (keeping ſtill an Equality) that at length the Equation may remain in the feweſt and ſimpleſt termes, ſo ordered, that the known Quantities may make one ſide of the Equation and the unknown the other, which Operation fits the Equation for Reſolution, and is called Reduction.

§ 2. *By Addition and Subtraction.*

WHen known Quantities be joyned or linked with unknown, in one side of an Equation, transfer Terms from one side of the Equations to the other, changing their Signs. This Operation it self is called *Transposition.*

	1	$DA - DC = A^2 + b^2 + DB + dc$
$1 - A^2$	2	$DA - DC - A^2 = b^2 + DB + dc$
$2 - DB$	3	$DA - DC - A^2 - DB = b^2 + dc.$

	1	$ac + RC = n$
$1 - ac$	2	$RC = n - ac.$

	1	$a^3 - \sqrt{5}B^2 = ry - A^2.$
$1 + A^2$	2	$A^2 + a^3 - \sqrt{5}B^2 = ry.$
$2 - a^3$	3	$A^2 - \sqrt{5}B^2 = ry - a^3.$

	1	$y^2 + 5A^2 = A^2 + rr.$
$1 - A^2$	2	$y^2 + 4A^2 = rr.$
$2 - y^2$	3	$4A^2 = rr - y^2.$

§ 3. *By Multiplication.*

IF the Quantity sought, or any Degree or Power thereof be in a Fraction, reduce, as in Reduction of Fractions (*viz.* by cross multiplying) the parts thereof to one Denomination; that omitting that common Denominator, the Equation may be expressed by the Numerators only.

	1	$a = \frac{D^2}{a-r}.$
$1 \times \overline{a-r}$	2	$a^2 - ar = D^2.$

	1	$a + c = \frac{An}{b}$
$1 \times b$	2	$ba + bc = An.$

	1	$\frac{3vv}{c} = \frac{B^2}{n}.$
$1 \times nc$	2	$3nvv = B^2C.$

	1	$\frac{e^3}{e^2 - ne + N^2} = \frac{rA}{1}.$
$1 \times \overline{e^2 - ne + N^2}$	2	$e^3 = rAe^2 - rAne + rAN^2.$

To clear an Equation of the Radical Sign. When there is an Equation between Homogeneal Surds, cast away the Radical Sign, and let the Equation stand in Rational Quantities.

When

When one part of an Equation is a Surd Quantity, and the other a Rational, multiply the Rational part either Quadraticly, or Cubicly, &c. according to the Index of the Radical Sign, and cast away the Radical Sign from the other part.

	1	$b + r = \sqrt{e}$
1 ⓖ 2	2	$b^2 + 2br + r^2 = e.$

$\sqrt{:}\,\overline{ac - n} = c$
$ac - n = c^2.$

§ 4. *By Division.*

IF the known Quantity be found in each Member of an Equation, divide the whole Equation by the least Degree of the unknown Quantity, which shall clear one Member or Term thereof from the unknown Quantity.

	1	$Ba^2 - 15Ra = a$
$1 \div a$	2	$Ba - 15R = 1.$

$a^3 + Xa^2 = C^3a$
$a^2 + Xa = C^3.$

If the highest Power of the unknown Quantity be multiplied in a known, divide the Equation by that known Quantity, thereby clearing the highest Power of the unknow from all the known Quantities.

	1	$Ba^3 - 3Ra = N.$
$1 \div B$	2	$a^3 - \frac{3Ra}{B} = \frac{N}{B}.$

	1	$Da^2 - 5a^3 = B - 18.$
$1 \div 5$	2	$\frac{Da^2}{5} - a^3 = \frac{B-18}{5}.$

§ 5. *To convert Analogies into Equations.*

IF four Quantities be Proportional, the Product of the Extreams is equal to the Product of the Means. 16, 17 e 6.

If three Quantities be Proportional, the Product of the Extreams is equal to the Square of the Mean. 19, 20 e 7.

	1	$7 \,.\, a :: b \,.\, \frac{ab}{7}$
$7 \times \frac{ab}{7}$	2	ab
$a \times b$	3	ab
2, 3	4	$ab = ab$

	1	$a \,.\, b :: c \,.\, d$
$a \times d$	2	ad
$b \times c$	3	bc
2, 3	4	$ad = bc$

$1 \times 4.$

	1	n
	2	r
	3	al
	4	y
	5	$n \,.\, r :: al \,.\, y$
1×4	6	ny
2×3	7	ral
$6,\ 7$	8	

§ 6. *To convert Equations into Analogies.*

IF the Rectangle of two Quantities be equal to the Rectangle or Product of two other; say, *As* either of the Factors in one side of the Equation, *Is* to either of the Factors in the other part: *So* is the other Factor in the last part, *To* the other Factor in the first part.

1	$ba = an$	$rl = 7ny$	$\frac{ry}{b} = a.$
2	$b \,.\, n :: a \,.\, a$	$r \,.\, 7n :: y \,.\, l$	$b \,.\, r :: y \,.\, a$

§ 7. *The Order in which those Reductions are to be used, in Clearing and Trimming an Equation.*

1. IF there be any Fractions in an Equation, let them be cleared of their Denominators by § 3. *Chap.* 4. also by the same, let the Surd Character be taken away, if there be any.

2. If the unknown Quantity be found in all the Terms, you must clear as many of the Terms of it as may be, by § 4. *Chap.* 4. but if all the Terms may be cleared, that Equation is Identical and vain, and may be resolved by any Number whatever.

3. If several like terms be distributed, let them be gathered into one Term by the prescription of their Signs and known Factors, placing the highest Power of the unknown Quantity first (most finisterly) and the rest of the inferiour Powers, or Parodical Degrees, succeeding in their order, the Absolute possessing the other side of the Equation, by § 2. *Chap.* 4.

4. If there be a known Factor in the now first Term, or highest Power of the unknown, let it be cleared by § 4. *Chap.* 4.

Equations thus cleared and reduced are either Pure and Simple, or Adfected and Compound.

Pure and Simple Equations are such whose unknown part or side is a Simple Root or Power.

An Adfected, or Compound Equation, is that wherein there are two or more differing Degrees or Powers of the unknown Quantity.

CHAP.

CHAP. V.

Questions producing a Simple Equation.

1. A Certain Man goeth 29 Miles a day, another followeth him from the same place, but setteth forth 7 days after, and goeth $36\frac{1}{2}$ Miles each day. In how many days will the last overtake the first?

	1	$B = 203 = 29 \times 7$	
	2	$C = 29$	
	3	$D = 36\frac{1}{2}$	
	4	$y?$	
4×3	5	yD	$\frac{73}{2}y$
4×2	6	yC	$29y$
$6+1$	7	$yC+B$	$29y+203$
$7,\ 5$	8	$yC+B=yD$	$29y+203=\frac{73}{2}y$
$8-yC$	9	$yD-yC=B$	$\frac{73}{2}y-29y=203$
$9 \div \overline{D-C}$	10	$y=\frac{B}{D-C}.$	$y=\frac{203}{7.5}.$

2. A certain Man finding divers Poor People at his door, gave each of them 3 *d.* and had 6 *d.* remaining in his pocket; but if he would have given them 4 *d.* each, he must have wanted 2 *d.* How many Poor were there?

		d.	
	1	$B=3$	
	2	$C=6$	
	3	$D=4$	
	4	$H=2$	
	5	$y=?$	
1×5	6	By	$3y$
6×2	7	$By+C$	$3y+6$
$3+5$	8	Dy	$4y$
$8-4$	9	$Dy-H$	$4y-2$
$7,\ 9$	10	$Dy-H=By+C.$	$4y-2=3y+6$
$10-By+H$	11	$Dy-By=C+H$	$4y-3y=8$
$11 \div \overline{D-B}$	12	$y=\frac{C+H}{D-B}.$	$y=8.$

3. The

3. The Sum of two Numbers S, 84 and their Difference D, 39: what a the Numbers?

	$y = ?$	1	$y + z = S$	$y + z = 84$
	$z = ?$	2	$y - z = D$	$y - z = 39$
Rule 1.	$1 + 2$	3	$2y = D + S$	$2y = 123$
	$3 \div \overline{2}$	4	$y = \frac{D + S}{2}$	$y = 61\frac{1}{2}$.
	$1 - 2$	5	$2z = S - D$	$2z = 45$
	$5 \div \overline{2}$	6	$z = \frac{S - D}{2}$.	$z = 22\frac{1}{2}$.

4. The Sum of two Numbers S (9) and quintuple product $5P$ (100) given, to find the Numbers?

Rule 2.	y ?	1	$y + z = S$	$y + z = 9$
	z ?	2	$5yz = 5P$	$5yz = 100$
	$2 \div \overline{5}$	3	$yz = P$	$yz = 20$
	$1 \times y$	4	$y^2 + yz = Sy$	$y^2 + yz = 9y$
	$4 - 3$	5	$y^2 = Sy - P$	$y^2 = 9y - 20$
	$5 - y^2$	6	$Sy - y^2 = P$.	$9y - y^2 = 20$

Which happening to be an adfected Equation, the Solution must be omitted till a fit place.

5. There be two Numbers whose difference is D 7, with this property, that if the lesser be multiplied by B 2, and C (3) added to the Product, the Sum may equal the greater multiplied by F 6 and V 1 added to that Product? what be the Numbers?

Rule 3.	$y = ?$	1	$y - z = D$	$y - z = 7$
	$z = ?$	2	$zB + C = yF + V$	$2z + 3 = 6y + 1$
	$1 + z$	3	$y = D + z$	$y = 7 + z$
	$3 \times F$	4	$FD + Fz$	42
	2 *aliter*	5	$zB + C = FD + Fz + V$	$2z + 3 = 43 + 6z$
	$5 - Fz$	6	$zB - Fz + C = FD + V$	$3 = 43 + 4z$
	$6 - C$	7	$zB - Fz = FD + V - C$	$3 - 43 = 4z$ *or* $-40 = 4z$
	$7 \div \overline{B - F}$	8	$z = \frac{FD + V - C}{B - F}$.	$\frac{-40}{4} = -10 = z$?
	$1 + z - D$	9	$y - D = z$	$y - 7 = z$
	$9 \times B$	10	$By - BD$	$2y - 14$
	2 *aliter*	11	$By - BD + C = yF + V$	$2y - 11 = 6y + 1$
	$11 - yF$	12	$By - yF - BD + C = V$	$2y - 6y - 11 = 1$
	$12 - C + BD$	13	$By - Fy = V + BD - C$	$-4y = 12$
		14	$y = \frac{V + BD - C}{B - F}$	$y = \frac{12}{4} = -3$?

THE

THE SIX

FIRST BOOKS OF Euclid's Elements.

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THE

FIRST BOOK OF Euclid's Elements.

DEFINITIONS.

1. A *Point* is that which hath no Parts.

2. A *Line* is length without breadth.

3. The ends, or limits of a *Line*, are Points.

4. A *Right-Line* is that which lieth evenly between its terminating Points.

5. A *Superficies* is that which hath only length and breadth.

6. The extreams, or limits of a *Superficies*, are Lines.

7. A *Plain-Superficies* is that which lieth evenly betwixt its Lines.

8. A *Plain-Angle* is the Inclination of two Lines one to the other, the one touching the other in the same Plain, yet not lying in the same strait Line.

9. If the Lines which contain the Angle be Right-Lines, it is called a *Right-lined Angle*.

10. When a Right-Line *AB* ſtanding on a Right-Line *C D*, makes the Angles on either ſide thereof, *viz.* *A B C*, *A B D*, equal, then they are *Right-Angles*; and the Right-Line *A B* which ſtandeth upon the other is a Perpendicular to that on which it ſtands, *C D*. The mark for the Perpendicular is ⊥, and for a Right-angle ∟.

An *Angle* is marked commonly either with one Letter, which is ſet at the Angular Point, or with three; the middlemoſt whereof ſhews the Angular Point; and the other Letters the Lines that make that Angle: As the Angle which the Right-Lines *A B*, *C B*, make at *B*, is called *CBA*, or *A B C*, or *B*, omitting the Letters *A* and *C*.

11. An *Obtuſe-Angle* is that which is greater than a Right-Angle, as *EBC*.

12. An *Acute-Angle* is that which is leſs than a Right-Angle, as *E B D*, and its Character ſhall be ∠, which is alſo uſed for the word *Angle*, when the kind is undetermined.

13. A *Limit*, or *Term*, is the end of any thing.

14. A *Figure* is that which is contained under one or more Terms.

15. A *Circle* is a plain Figure contained under one Line, which is called a *Circumference*, unto which all the Lines *DA*, *D B*, *DC*, drawn from one Point within the Figure, are equal one to the other.

16. And that Point is called the *Center of the Circle*, the Character for a Circle is ⊙.

17. A *Diameter of a Circle* is a Right-Line *A B*, drawn through the Center thereof *D*, and terminated on either ſide by the Circumference *A* and *B*, and it divides the Circle into two equal parts.

18. A *Semicircle* is a Figure contained under the Diameter *A B*, and that part of the Circumference *ADB*, which is cut off by the Diameter.

19. *Right-lined Figures* are ſuch as are contained under Right Lines.

20. *Three Sided*, or *Trilateral Figures* are ſuch as are contained under three Right-Lines.

21. *Four Sided*, or *Quadrilateral Figures*, are ſuch as are contained under four Right-Lines.

22. *Many Sided Figures*, or *Multilaterals*, are ſuch as are contained under more Right-Lines than four.

23. Of *Trilateral Figures*, that is an *Equilateral* △, which hath three equal Sides, as the △ *A*.

24. An *Iſoſceles* is a △ which hath only two Sides equal, as the △ *B*.

25. *Scalenum* is a △ whoſe three Sides are all unequal, as *C*.

26. Of theſe *Trilateral Figures*, a *Right-Angled* △ is that which hath one Right ∠.

27. An *Amblygonium*, or *Obtuſe-Angled* △, is that which hath one Obtuſe ∠.

28. An *Oxygonium*, or *Acute-Angled* △, is that which hath three Acute ∠ˢ.

[illegible] An *Equiangular Figure* is that whereof all the ∠ˢ are equal. The ſame is to be underſtood of *Equilaterals*.

29. Of *Quadrilateral*, or four ſided *Figures*, a Square is that whoſe ſides are equal, and ∠ˢ *Right*; as *A B C D*.

30. A *Figure* on the one part longer, or an *Oblong*, is that which hath *Right* ∠ˢ, but not equal ſides; as *A B C D*.

31. A *Rhombus*, or *Diamond-Figure*, is that which hath Four equal ſides, but not ∟ˢ: as *A*.

32. A *Rhomboides* is that whoſe oppoſite ſides and oppoſite ∠ˢ are equal; but hath neither equal ſides nor ∟ˢ; as *B*.

33. All other *Quadrilateral Figures* beſides theſe, are called *Trapezia*, as the *Figure C*.

34. *Parallel* or *Equidiſtant Right-Lines*, are ſuch, as being on the ſame plain, if *Infinitely produced*, would never meet; as *A*, and *B*. And their mark is ||.

35. A *Parallelogram* is a *Quadrilateral Figure*, whoſe oppoſite Sides are *Parallel*; as the □, ▭, ▱, ▱. Square, *Oblong*, *Rhombus*, and *Rhomb*; and its Character is ▯.

36. When in a ▯ *A B E D* are drawn the *Diameter* (or rather *Diagonal*) *D B*, and two Lines *H K*, *C F Parallel* to the Sides, cutting the *Diameter* in one and the ſame Point *G*, ſo that the ▯ be divided by them into Four ▯ˢ thoſe two *A G*, *G E*, through which the *Diameter* paſſes not, are called the *Complements* of thoſe ſtanding about the *Diameter*; *viz.* of *H F*, and *C K*.

Whatever is propoſed to be either done or demonſtrated is called a *Propoſition*; and is either *Problem* or *Theorem*.

A *Problem*, is ſomewhat propoſed to be done or effected.

A *Theorem*, is ſomewhat propoſed to be Demonſtrated.

A *Corollary*, is ſome conſequent Truth gained from a preceeding Demonſtration.

A *Lemma* is the Demonſtration of ſome Premiſe, whereby the proof of the thing about, becomes the ſhorter.

An *Axiome*, is that which is ſelf evident, and is Comprehenſible at the firſt propoſing to all.

Poſtulates or *Petitions*.

1. From any point as *A*, to any point *B*, to draw a Right-Line *A B*.
2. To produce a *Finite* Right-Line, *AB* ſtrait forth continually.
3. Upon any Center, and at any Diſtance or Extent, to Deſcribe a Circle.

Axioms.

1. Things equal to the ſame, are alſo equal one to the other; As $a=b=c=d=f$; Therefore $a=f$, and conſequently all a, b, c, d, f, are equal one to the other.

2. If to equal things, equal things be added, the wholes will be equal.

3. If from equal things, equal things be taken away, the remains will be equal.

4. If to unequal things, equal things be added, the wholes will be unequal.

5. If from unequal things, equal things be taken, the Remainders will be unequal.

6. Things which are double to the same thing, are equal one to the other. Understand the same of Triple, Quadruple, *&c.*

7. Things which are half one and the same thing, are equal one to the other. Understand the same of Subtriple, Subquadruple, *&c.*

8. Things which agree together, are equal one to the other.

The converse of this *Axiom* is true in Right-Lines and $\angle^s$, but not in *Figures*, unless they be like.

Magnitudes are said to agree, when the parts of the one being apply'd to the parts of the other they fill up an equal place.

9. Every whole is greater then it's part.

10. All Right $\angle^s$ are equal between themselves.

11. Two Right-Lines cannot have one and the same Segment (or part) common to them both.

12. Two Right-Lines meeting in the same point, if they be both produced, shall necessarily cut one the other in that Point.

13. If a Right-Line BA falling on two Right-Lines AD, CB, make the *Internal* $\angle^s$ on the same Side, $BAD + ABC$, $\sqsupset 2 \llcorner^s$, those two Right-Lines produced shall meet on that Side, where the $\angle^s$ are $\sqsupset 2 \llcorner^s$.

14. Two Right-Lines do not contain a Space.

15. Every whole is equal to all its parts taken together.

The Citation in the Margent, understand thus, if there be two Numbers, the first shews the Proposition, the second the Book.

Ax. is for Axiom, *Post.* Postulate, *Def.* Definition, *Sch.* Scholium, *Cor.* Corollary. Also note, that *WWD*, stands for, *which was to be Demonstrated*, and *WWDn*, *which was to be done.* Further note, that *Pro.* stands for Proof; *Præ.* for Preparation; and *Pra.* for Praxis.

Prop. I.

Problem 1.

Upon a finite Right-Line given, A B, *to describe an equilateral* △, ACB.

(a) 3 *post.*
(b) 1 *post.*
(c) 15 *def.*
(d) *d.* 1. *ax.*
(e) 23 *def.*

ON the Centers A and B, with the extent AB or BA, [a] describe two $\bigcirc^s$ cutting each other in the point C: from whence [b] draw the two Right-Lines CA, CB. Then is AC [c] $= AB = BC$ [d] $= AC$, [e] Wherefore the $\triangle\, ACB$ is Equilateral. *WWDn.*

Scholium.

Scholium.

After the same manner may be described upon the Line AB an Isosceles △, if the Semidiameters of the equal $\bigcirc^s$ be taken greater or lesser than the line AB.

Prop. II.

At a point given, A, *to make a Right-Line,* A G, *equal to a given Right-Line,* B C. Problem 2.

(a) 3 *post.*
(b) 1 *post.*
(c) 1. 1.
(d) 2 *post.*
(e) 2 *post.*
(f) 15 *def.*
(g) *const.*
(h) 3 *ax.*
(i) 15 *def.*
(k) 1 *ax.*

ON the Center C, with the Extent CB, [a] describe the $\bigcirc\, CBE$; [b] joyn AC; upon which [c] make the Equilateral $\triangle\, ADC$. [d] Produce DC to E. On the Center D, with the Extent DE, describe the $\bigcirc\, DEH$; and let DA [e] be produced to the point G. Then $AG = CB$.

For DG [f] $= DE$, and DA [g] $= DC$. Wherefore AG [h] $= CE$ [i] $= BC$ [k] $= AG$. *WWDn.* The falling of the point A, within or without the Line BC varies the Case; yet the Construction and Demonstration continue the same.

Scholium.

This, and the preceding Problem might be performed much easier, mechanically with a pair of Compasses; but that will answer to no postulate, as intimated by *Proclus.*

Prop. III.

Two unequal Right-Lines, A *and* B C, *being given, to take from the greater,* B C, *the Right-Line* B E, *equal to the lesser* A. Problem 3.

(a) 2. 1.
(b) 15 *def.*
(c) *constr.*
(d) 1 *ax.*

TO the point B [a] draw the Right-Line $BD = A$. The $\bigcirc$ Described on the Center B with the Extent BD shall cut off BE [b] $= BD$ [c] $= A$ [d] $= BE$. *WWDn.*

Prop. IV.

Prop. IV.

Theorem 1. *If two △s* BAC, EDF, *have two sides of the one equal to two sides of the other, that is,* AB *to* DE *and* AC *to* DF *and the* ∠s *contained by these sides,* viz. A *and* D *equal: they shall have the base* BC *equal to the base* EF; *and the* △BAC=△EDF; *and the remaining* ∠s *of the one shall be equal to those remaining of the other, each to its correspondent, that is,* B *to* E, *and* C *to* F *according to the equal subtending sides.*

Pro. THe side *AB* is put equal to the side *DE*, and the side *AC* to *DF*, and the ∠*A* to ∠*D*: Therefore if they be apply'd one upon
(a) *hyp.* the other [a] they will have the same terms and agree, the basis *BC* to the basis
(b) 14 *ax.* *EF*. And consequently the whole △ [b] shall agree, and be equal to the whole △ on which it's placed, that is △*EDF* to △*BAC*, *WWD*.

Prop. V.

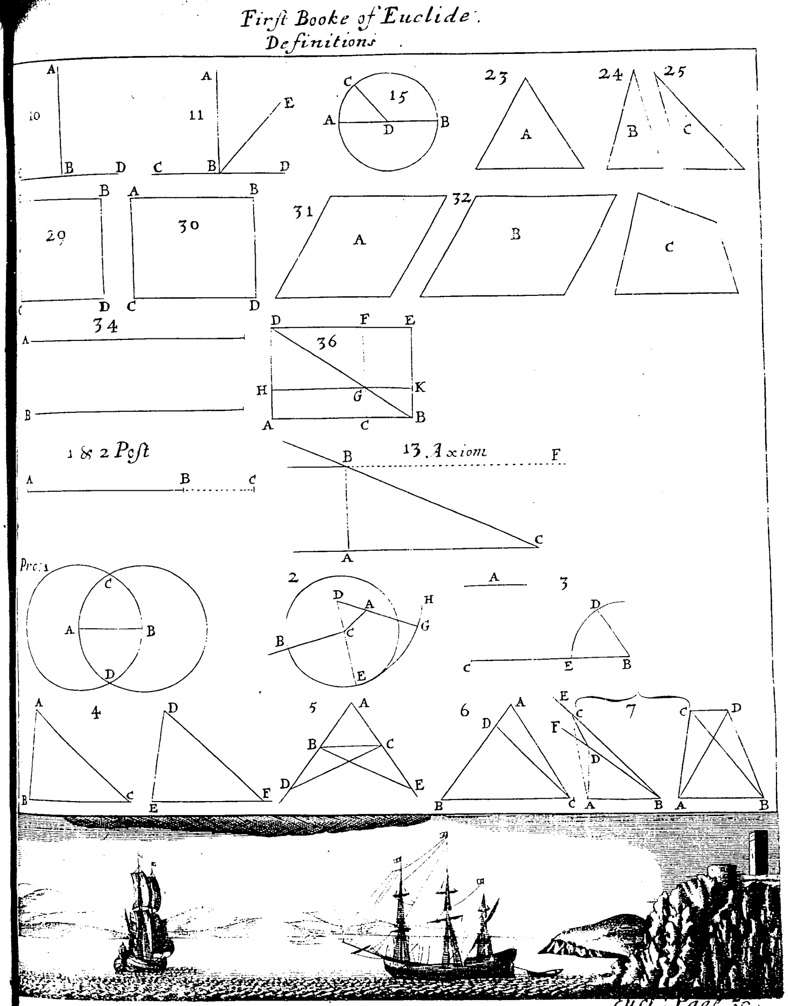
Theorem 2. *The* ∠s ABC, ACB, *at the base of an Isosceles* △ABC, *are equal: and if the equal sides* AB, AC *be produced, the* ∠s CBD, BCE *under the base, shall be equal.*

(a) 3 1. *Prepar.* [a] TAke *AE*, = *AD*; and [b] joyn *CD* and *BE*.
(b) 1 *post.* *Pro.* Because, in the △s *ACD*, *ABE*, *AB* [c] = *AC*, and *AE*
(c) *hyp.* [d] = *AD*, and the ∠*A* common to both, [e] therefore is the ∠*ABE*=*ACD*,
(d) *constr.* and the ∠*AEB* [c] = *ADC*, and the base *BE* [c] = *CD*; also *EC* [f] = *DB*.
(e) 4 1. Therefore also in the △s *BEC*, *BDC* [g] shall be the ∠*ECB* = *DBC*.
(f) 3 *ax.* *WWD*. By like reason is the ∠*EBC* = *DCB*, but the ∠*ABE* [h] = *ACD*; therefore the ∠*ABC* [i] = *ACB*, *WWD*.
(g) 4. 1.
(h) *before.*
(i) 3 *ax.*

Corol.

Thales Autor hujus Pro. Every Equilateral △ is also Equiangular.

Prop. VI.



Prop. VI. Theorem 3.

If two ∠s, A B C, A C B, *of a* △, A B C, *be equal, the ſides,* A B, A C, *ſubtending theſe equal* ∠s, *ſhall alſo be equal one to the other.*

Prep. IF the ſides be not equal, let one be longer than the other, ſuppoſe (a) 3. 1.
B A ⊏ *C A*, [a] make *B D* = *C A*, and [b] draw the line *C D*. (b) 1. *poſt.*
Pro. In the △s *D B C*, *A C B*, becauſe *B D* [c] = *C A*, and the ſide *B C* is (c) *ſuppo.*
common, and the ∠ *D B C* [d] = *A C B*, the △s *D B C*, *A C B* [e] ſhall be (d) *hyp.*
equal the one to the other, a part to the whole [f] which is impoſible. (e) 4. 1. (f) 9 *ax.*

Corol.

Every Equiangular △ is alſo Equilaterial.

Prop. VII Theorem 4.

Upon the ſame Right-Line A B, *two Right-Lines being drawn* A C, B C, *two other Right-Lines* A D, B D, *equal to the former, each to each* (viz. A D = A C, *and* B D = B C) *cannot be drawn from the ſame points* A, B, *on the ſame ſide, to ſeveral points, as* C *and* D, *but only to* C.

Pro 1. *Caſe.* IF the point *D* be in the Line *A C*; it's evident that *A D*
is [a] not equal to *A C*. (a) 9 *ax.*

2. *Caſe.* If the point *D* be within the △ *A C B*, then draw *C D*, and
produce *B D F*, and *B C E*. Now if it muſt be *A D* = *A C*, then the ∠ (b) 5. 1.
A D C [b] = *A C D*; as alſo, becauſe *B D* [c] = *B C*, the ∠ *F D C* = [b] *E C D*, (c) *ſuppoſ.*
therefore the ∠ *F D C* ⊏ [d] *A D C* alſo the ∠ *E C D* ⊏ *A C D*. [d] Which is (d) 9 *ax.*
impoſſible.

3. *Caſe.* If *D* be without the △ *A C B*, joyn *C D*.
Again, the ∠ *A C D* [e] = *A D C*, and the ∠ *B C D* [e] = *B D C*, [f] There- (e) 5. 1.
fore the ∠ *A C D* ⊏ *B D C*, *ſcil.* the ∠ *A D C* ⊏ *B D C* a part to the (f) 9 *ax.*
whole. Which is impoſſible. Therefore &c.

Prop. VIII.

Theorem 5. *If two* $\triangle$*s* ABC, DEF, *have two ſides of the one equal to two ſides of the other,* viz. $AB = DE$, *and* $AC = DF$, *and the baſes equal,* $BC = EF$; *then the* $\angle$*s contained under the equal Right-Lines ſhall be equal,* viz. A *to* D.

(a) hyp.
(b) 8 ax.
(c) hyp.
(d) 7. 1.
(e) 8 ax.

Pro. Becauſe BC [a] $= EF$, if the baſe BC be laid on the baſe EF, [b] they ſhall agree; therefore whereas AB [c] $= DE$, and $AC = DF$, the point A [d] will fall on D, and ſo the ſides of the $\angle$s A and D are coincident; [e] wherefore thoſe $\angle$s are equal. *WWD.*

Corol.

(f) 4. 1.

1. $\triangle$s mutually equilateral are alſo mutually [f] Equiangular.
2. $\triangle$s mutually equilateral [f] are equal one to the other.

Prop. IX.

Problem 4. *To divide a Right-Lined* $\angle$ *given* BAC *into two equal parts.*

(a) 3. 1.
(b) 1. 1.

Præ. [a] Make $AD = AE$, drawing DE; on which [b] make an equilateral [c] $\triangle DFE$. So drawing the Right-Line AF; it ſhall biſect the $\angle$ as required.

(c) conſtr.
(d) 8. 1.

Pro. For AD [c] $= AE$, and the ſide AF is common, and the baſe DF [c] $= FE$. [d] Therefore the $\angle DAF = EAF$. *WWDn.*

Corol.

Hence it appears how an $\angle$ may be cut into any equal parts in a Geometrical progreſion as 4, 8, 16, &c. *viz.* By a continual Subſection of each part again. But the method of dividing $\angle$s into other parts by a Scale and Compaſſes, is as yet unknown.

Prop. X.

Problem 5. *To divide a Right-Line given* GH *into two equal parts.*

(a) 1. 1.

Præ. Upon GH [a] make an equilateral $\triangle GAH$, and biſect the $\angle A$ with the Right-Line AF. That Line ſhall alſo biſect the given Line GH.

(c) conſtr.
(d) 4. 1.

Pro. For GA [c] $= HA$, and AI is common, and the $\angle GAI$ [c] $= HAI$, therefore [d] $GI = IH$. *WWDn.*

Prop. XI.

Prop. XI.

Problem 6.

From a point I, *in a given Right-Line* DF, *to raiſe a Right-Line* IA *at Right* $\angle$*s.*

(a) 3. 1.
(b) 1. 1.
(c) conſtr.
(d) 23 def.
(e) 8. 1.
(f) 10 def.

Præ. [a] Take on either ſide of the point I an equal ſpace *viz.* $DI = IE$, and on DE [b] make an equilateral $\triangle DAE$, then draw AI, and it will be the Perpendicular required.

Pro. For [c] $DI = IE$, and [d] $DA = AE$, and AI is common. [e] Therefore the $\angle AID = AIE$, [f] and conſequently right: Whence AI muſt be a $\perp$. *WWDn.*

Prop. XII.

Problem 7.

Upon an infinite Right-Line given DE, *from a given point* A *without it, to let fall a Perpendicular Right-Line* AI.

(a) 3 poſt.
(b) 10. 1.

Præ. On the center A, [a] deſcribe a Circle cutting DE, the given Right-Line in the points D and E. Then [b] biſect DE in I drawing AI, which will be the $\perp$ required.

(c) conſtr.
(d) 8. 1.
(e) 10 def.

Pro. Daw AD, AE. Then the $\triangle$s AID, AIE, are mutually [c] equilateral. [d] Therefore the $\angle$s $DIA = EIA$, and conſequently right. [e] Wherefore AI is a $\perp$. *WWDn.*

Prop. XIII.

Theorem 6.

When a Right-Line EB *ſtanding upon a Right-Line* CD *makes* $\angle$*s; thoſe* $\angle$*s ſhall be either* 2 $\llcorner$*s, or together equal to* 2 $\llcorner$*s.*

(a) 10 def.
(b) 11. 1.
(c) 15 ax.
(d) 3 ax.
(e) 2 ax.

Pro. If the $\angle$s EBD and EBC be equal, [a] they are 2 $\llcorner$s; if unequal, from the point B [b] raiſe $BA \perp$. Becauſe the $\angle EBC$ [c] $= \llcorner + ABE$, and the $\angle EBD$ [d] $= \llcorner - ABE$, therefore ſhall be $EBC + EBD$ [e] $= 2 \llcorner s + ABE - ABE = 2 \llcorner s$. *WWD.*

Corol.

1. If one $\angle EBD$ be right, the other EBC is alſo right; if one acute, the other is obtuſe; and the contrary.
2. If more Right-Lines than one ſtand upon the ſame Right-Line at the ſame point, the $\angle$s ſhall be equal to 2 $\llcorner$s.
3. Two Right-Lines cutting each other make $\angle s = 4 \llcorner s$.
4. All the $\angle$s about one point $= 4 \llcorner s$. by *Corol.* 2.

Prop.

Theorem 7.

Prop. XIV.

If to any Right-Line DE, *and point therein* C, *two Right-Lines*, DC, CE, *be drawn from contrary sides, making the* $\angle^s$ ACD $+$ ACE, $= 2\ \llcorner^s$, *the lines* DC, CE, *shall make one strait Line.*

(a) 13. 1.
(b) *hyp.*
(c) 9 *ax.*

Pro. IF not; let *DC, CF*, make one Right-Line; then shall the $\angle$ *ACD* $+$ *ACF* [a] $= 2\ \llcorner s$ [b] $=$ *ACD* $+$ *ACE*, which is [c] absurd.

Theorem 8.

Prop. XV.

If two Right-Lines AB, CD, *mutually cut one the other; the opposite* $\angle^s$ *are equal* viz. AED $=$ CEB, *or* AEC $=$ DEB.

(a) 13. 1.
(b) 3 *ax.*

Pro. FOr the $\angle$ *AED* $+$ *DEB* $=$ *CEB* $+$ *DEB* $=$ [a] $2\ \llcorner s$, [b] therefore *CEB* $=$ *AED*.

Theorem 9.

Prop. XVI.

One side BA *of a* $\triangle$ ABC *being produced, the outward* $\angle$ EAC *will be greater than either of the inward opposite* $\angle^s$ C *or* B.

(a) 10. 1.
& 1 *post.*
e 15. 1.
(b) 3. 1.
(c) *constr.*
(d) 4. 1.

Pr. LEt the Right-Line *BG*, [a] bisect the side *AC*, [b] produce *FG* $=$ *FB*, and draw *AG*.

Pro. Because *AF* [c] $=$ *CF*, and *FG* [c] $=$ *FB*, and $\angle$ *AFG* [c] $= \angle$ *CFB*; [d] therefore also shall the $\angle$ *GAF* $= \angle$ *BCF*, and consequently the whole external $\angle$ *EAC* $\sqsubset$ *ACB* the internal opposite.

Also if the side *AB* be bisected in *I*, the same shall follow, and be proved the External $\angle$ *DAB* $\sqsubset \angle$ *ABC*.

(e) 15. 1.
(f) 9 *ax.*

Lastly, seeing the $\angle$ *EAC* [e] $= \angle$ *DAB*: [f] shall be the External $\angle$ *EAC* $\sqsubset \angle$ *C* or *B* either of the Internal opposite. *WWD.*

Theorem 10.

Prop. XVII.

Two $\angle^s$ *of any* $\triangle$ ABC, *which way soever they are taken, are less then* $2\ \llcorner^s$.

(a) 13. 1.
(b) 16. 1.
(c) 4 *ax.*

PRoduce *BC*. Because the $\angle$ *ACD* $+$ *ACB* [a] $= 2\ \llcorner s$, and the $\angle$ *ACD* [b] $\sqsubset$ *A*, [c] therefore *A* $+$ *ACB* $\sqsupset 2\ \llcorner s$. After the same manner is the $\angle$ *B* $+$ *ACB* $\sqsupset 2\ \llcorner s$. The side *AB* being produced, the $\angle s$ *A* $+$ *B* will be in like manner demonstrated less than $2\ \llcorner s$. *WWD.*

Corol.

Corol.

1. In every $\triangle$ where one $\angle$ is either right or obtuse, the two other are acute.
2. All the $\angle s$ of an equilateral $\triangle$, and the $2\ \angle^s$ of an Isosceles that are upon the base, are acute.
3. If a Right-Line *AE* make unequal $\angle s$ with another Right-Line *D*, *viz.* one acute *AED*, the other *AEC* obtuse, a Perpendicular *AD*, let fall from any point *A*, to the other line *CD*, shall fall on that side the acute $\angle$ is.

For if *AC*, drawn on the side of the obtuse $\angle$ be a $\perp$, then in the $\triangle$ *AEC* shall *AEC* $+$ *ACE* $\sqsubset 2\ \llcorner s$. *Which is contrary to the precedent Prop. (*) 17. 1.

Prop. XVIII. Theorem 11.

The greatest side AC *of every* $\triangle$ ABC *subtends the greatest* $\angle$ ABC.

Pro. FRom *AC* [a] take away *AD* $=$ *AB*, and joyn *BD*. [b] Therefore is the $\angle$ *ADB* $=$ *ABD*. But *ADB* [c] $\sqsubset$ *C*; [d] therefore the whole $\angle$ *ABC* $\sqsubset$ *C*. After the same manner, shall be *ABC* $\sqsubset$ *A*. *WWD.*

(a) 3. 1.
(b) 5. 1.
(c) 16. 1.
(d) 9 *ax.*

Prop. XIX. Theorem 12.

In every $\triangle$ ABC, *under the greatest* $\angle$ A, *is subtended the greatest side* BC.

Pro. FOr if it be admitted *AB* $=$ *BC*, then will the $\angle$ *A* [a] $=$ *C*, which is contrary to the Hypoth. If *AB* $\sqsubset$ *BC*, then shall be the $\angle$ *C* [b] $\sqsubset$ *A*, which is also against the Hypoth. Wherefore *BC* $\sqsubset$ *AB*. After the same manner *BC* $\sqsubset$ *AC*. *WWD.*

(a) 5. 1.
(b) 18. 1.

Note, This is but the Converse of the last Proposition, and therefore might have been omitted.

Prop. XX. Theorem 13.

Of every $\triangle$ ABC *two sides* BA, AC, *any way taken, are greater than the side that remains* BC.

Pro. PRoduce the line *AB*, [a] and take *AD* $=$ *AC*, and draw *DC*, [b] then shall the $\angle$ *D* $=$ *ACD*, [c] therefore is the whole $\angle$ *BCD* $\sqsubset$ *D*; [d] therefore *BD* ([e] *BA* $+$ *AC*) $\sqsubset$ *BC*. *WWD.*

(a) 3. 1.
(b) 5. 1.
(c) 9 *ax.*
(d) 19. 1.
(e) *constr.* & 2 *ax.*

Prop.

Theorem 14.

Prop. XXI.

If from the extream points of one side BC, *of a* $\triangle$ ABC, *two Right-Lines* BD, CD, *be drawn to any point within the* $\triangle$, *then are both those two Lines shorter than the two other sides of the* $\triangle$, BA, CA; *but do contain a greater* $\angle$, *that is, the* $\angle D \sqsubset \angle A$.

Pro. Produce BD to E. Then $CE + ED$ [a] $\sqsubset CD$, and making BD common to both, [b] then $BD + EC + DE \sqsubset CD + BD$. Again, $BA + AE$ [a] $\sqsubset BE$, [b] therefore $BA + AC \sqsubset BE + EC$. Wherefore 1. $BA + AC \sqsubset BD + DC$. 2. the $\angle BDC$ [c] $\sqsubset DEC$ [c] $\sqsubset$ [c] A. Therefore the $\angle BDC \sqsubset A$. WWD.

(a) 20. 1.
(b) 4 ax.
(c) 16. 1.

Problem 8.

Prop. XXII.

To make a $\triangle$ FKG *of three Right-Lines* FK, FG, GK, *which shall be equal to three Right-Lines given* A, B, C. *Of which it's necessary that any two taken together be longer than the third.*

Pra. On the infinite Right-Line DE, [a] take DF, FG, GH equal to the given lines A, B, C; Then if from the [b] centers F and G, with the extents FD and GH, two $\odot$s be described, cuting each other in K, and the Right-Lines KF, KG be drawn, the $\triangle FKG$ shall be made, [c] whose sides FK, FG, GK are equal to the three lines DF, FG, GH, [d] that is, to the three lines given A, B, C. WWDn.

(a) 3. 1.
(b) 3 post.
(c) 15 def.
(d) 1 ax.

Problem 9.

Prop. XXIII.

At a point C, *in a Right-Line given* AB, *to make a Right-Lined* $\angle$ GCB, *equal to a given Right-Lined* $\angle$ DEF.

Pra.[a] Draw the Right-Line DF cutting the sides of the given $\angle$ any ways. Pra. [b] Make $CG = ED$; and on CG [c] make a $\triangle CGB$, having equal sides to the former EDF, so that $CB = EF$, and $GB = DF$; then will $\angle C$[d] $= \angle E$. WWDn.

(a) 1 post.
(b) 3. 1.
(c) 22. 1.
(d) 8. 1.

Prop.

Prop. XXIV.

Theorem 15.

If 2 $\triangle$s ABC, DEF, *have two sides of the one equal to two sides of the other,* viz. $AB = DE$, *and* $AC = DF$, *and the* $\angle A \sqsubset \angle EDF$ *contained under the equal Right-Lines, they shall also have the base* $BC \sqsubset EF$ *the other base.*

Pra.[a] Make the $\angle EDG = \angle A$, and the side DG [b] $= DF$ [c] $= AC$; and joyn EG, and FG.

Pro. 1. *Case*. If EG fall above EF; Because AB [d] $= DE$, and AC [c] $= DG$ and the $\angle A$ [e] $= EDG$, [f] therefore is $BC = EG$. But because DF [e] $= DG$, [g] therefore is the $\angle DFG = DGF$; [h] therefore is the $\angle DFG \sqsubset EGF$, and consequently the whole $\angle EFG \sqsubset EGF$, [k] wherefore $EG = BC \sqsubset EF$.

2. *Case*. If the base EF fall in the same place with EG, [l] it's evident that $EG = BC \sqsubset EF$.

3. *Case*. If EG fall below EF, then because $DG + GE$ [m] $\sqsubset DF + FE$, if from both there be taken $DG = DF$, the remains EG (BC) [n] $\sqsubset EF$. WWD.

(a) 23. 1.
(b) 3. 1.
(c) hyp.
(d) hyp.
(e) const.
(f) 4. 1.
(g) 5. 1.
(h) 9 ax.
(k) 19. 1.
(l) 9 ax.
(m) 21. 1.
(n) 5 ax.

Prop. XXV.

Theorem 16.

If 2 $\triangle$s ABC, DEF, *have two sides of the one equal to two of the other; that is,* $AB = DE$, *and* $AC = DF$, *and the bases* $BC \sqsubset FE$, *they shall also have the* $\angle$s *contained under the equal Right-Lines one greater than the other* viz. $\angle A \sqsubset \angle D$.

Pro. For if the $\angle A = \angle D$, [a] then is the base $BC = EF$, which is contrary to the Hypothesis. If the $\angle A \sqsupset \angle D$, then [b] will $BC \sqsupset EF$, which is also against the Hypothesis. Therefore $BC \sqsubset EF$. WWD.

(a) 4. 1.
(b) 24 1.

Prop. XXVI.

Theorem 17.

If two $\triangle$s BAC, EDG, *have 2* $\angle$s *of the one* B, C, *equal to 2* $\angle$s *of the other* E, DGE, *each to his correspondent* $\angle$, *and have also one side of the one equal to one side of the other, either that side which lieth betwixt the equal* $\angle$s, *or that which is subtended under one of the equal* $\angle$s; *the other sides also of the one shall be equal to the other sides of the other, each to his correspondent side, and the other* $\angle$ *of the one shall be equal to the other* $\angle$ *of the other.*

Pro. Hyp. 1. Let $BC = EG$, which are the sides interjacent of the equal $\angle$s. Then shall $BA = ED$, and $AC = DG$, and the $\angle A = EDG$. For if $ED \sqsubset BA$, then [a] make $EH = BA$, and draw GH.

(a) 3. 1.

Because

(b) suppos. (c) hyp. (d) 4. 1. (e) hyp. (f) 9 ax. (g) hyp. (h) suppos. (k) 4. 1. (l) hyp. (m) 16. 1. Thales Milesius.

Because AB [b] $= HE$, and BC [c] $= EG$, and the $\angle B$ [c] $= E$, therefore shall the $\angle EGH$ [d] $= C$ [e] $= DGE$, [f] which is absur'd. In like manner let $AC = DG$, then will the $\angle A = EDG$.

2. *Hyp.* Let $AB = ED$. Then I say $BC = EG$, and $AC = DG$, and the $\angle A = EDG$. For if $EG \sqsubset BC$, make $EI = BC$, and draw DI. Now because AB [g] $= ED$, and BC [h] $= EI$, and the $\angle B$ [g] $= E$; therefore will the $\angle EID$ [k] $= C$ [l] $= EGD$, [m] which is absurd. Therefore is $BC = EG$, and so as before $AC = DG$, and the $\angle A = EDG$. *WWD.*

Theorem 18.

Prop. XXVII.

If a Right-Line EF *falling upon two Right-Lines* AB, CD, *make the alternate* $\angle$s AGH = DHG, *then are the Right-Lines* AB, CD *parallel.*

(a) 16. 1.

Pro. If not, produce them till they meet in *I*, and then shall the outward $\angle AGH$ [a] $\sqsubset GHD$ the internal opposite, to which it was by Hyp. equal. Which is repugnant.

Theorem 19.

Prop. XXVIII.

If a Right-Line EF *falling upon two Right-Lines* AB, CD, *make the outward* $\angle$ *of the one line* AGE = $\angle$CHG *the inward, and opposite of the other on the same side, or make the inward* $\angle$s *on the same side* viz. AGH + CHG 2 ∟s, *then are the Right-Lines* AB, CD *parallel.*

(a) 15. 1. (b) 27. 1.

Pro. Hyp. 1. Because by Hyp. the $\angle AGE = CHG$, [a] therefore are the alternate $\angle BGH = CHG$: and [b] therefore $AB \parallel CD$.

(a) 13. 1. (b) 3 ax. (c) 27. 1.

Hyp. 2. Because by Hyp. the $\angle AGH + CHG = 2$ ∟s, [a] $= AGH + BGH$, [b] is $CHG = BGH$; and [c] therefore $AB \parallel CD$. *WWD.*

Theorem 20.

Prop. XXIX.

If a Right-Line EF, *fall upon two parallels* AB, CD, *it will make the alternate* $\angle$s BGH *and* GHC *equal one to the other; and the outward* $\angle$ EGB *equal to the inward opposite* $\angle$ *on the same side* EHD, *as also the inward* $\angle$s *on the same side* AGH, CHG, *equal to* 2 ∟s.

(a) 13. 1. (b) 28. 1. (c) 3 ax.

Pro. Part. 1. The $\angle$s $DHG + GHC =$ [a] 2 ∟s: also $DHG + BGH =$ [b] 2 ∟s, [c] and taking from each the common $\angle DHG$, there shall remain $BGH = GHC$.

Part. 2

(d) 13. 1. (e) 28. 1.

Part. 2. The $\angle$s $EGB + BGH =$ [d] 2 ∟s; and $BGH + GHD$ [e] $=$ 2 ∟s, and taking from each the common $\angle BGH$, there shall remain $EGB = GHD$.

(f) 34 def.

Part. 3. The Right-Lines AB, CD are parallels by the *Hyp.* [f] and cannot meet, therefore the inward $\angle$s on the same side both towards A and B are equal to 2 ∟s. *WWD.*

Corol.

Every ▯, having one ∟, is a Right-Angled ▯, and hath all the rest of the $\angle$s right.

Prop. XXX.

Theorem 21.

Right-Lines (AB, CD) *parallel to one and the same Right-Line* EF, *are also parallel the one to the other.*

(a) 29. 1. (b) 1 ax. (c) 27. 1.

Pre. Draw GI cutting the three Right-Lines given any ways.
Pro. Then because $AB, \parallel EF$ will the $\angle AGI$ [a] $= EHI$, also because $CD, \parallel EF$, will the $\angle EHI$ [a] $= DIG$. [b] Therefore the $\angle AGI = DIG$, [c] whence will be $AB \parallel CD$. *WWD.*

Prop. XXXI.

Problem 10.

From a point given A, *to draw a Right-Line* AE, *parallel to a Right-Line given,* BC.

(a) 23. 1. (b) 27. 1.

Pra. From the point A draw a Right-Line AD to any point of the given Right-Line; with which at the point thereof [a] A make an $\angle DAE = ADC$, [b] then will be $AE \parallel BC$. *WWDn.*

Prop. XXXII.

Theorem 22.

Of any △ ABC *one side* BC *being produced, the outward* $\angle$ ACE, *shall be equal to the two inward opposite* $\angle$s A, B, *and the three inward* $\angle$s *of the* △, A, B, ACB *shall be equal to* 2 ∟s.

(a) 31. 1. (b) 29. 1. (c) 2 ax. (d) 15 ax. (e) 13. 1. (f) 1 ax. Pythagoras Samius.

Pro. From C [a] draw $CD \parallel BA$. Then is the $\angle A$ [b] $= ACD$, and the $\angle B$ [b] $= DCE$. Therefore $A + B$ [c] $= ACD + DCE$ [d] $= ACE$. *WWD.*
Also $ACE + ACB$ [e] $= 2$ ∟s; [f] therefore $A + B + ACB = 2$ ∟s. *WWD.*

Corol.

Coroll.

1. The 3 ∠s of any Right-Lined △ together, are equal to the 3 ∠s of any other Right-Lined △ so taken. Whence,

2. If in one Right-Lined △, 2∠s (taken severaly, or together) = 2∠s of another Right-Lined △ (so taken) then shall their remaining ∠s be also equal. Likewise, if 2 △s have one ∠ of the one equal to one of the other, then is the sum of the remaining ∠s of the one △, equal to the sum of the remaining ∠s of the other.

3. If one ∠ of a Right-Lined △ be Right, the other two together are equal to a Right. Also, that ∠ of a Right-Lined △ which is equal to the other 2 ∠s is it self a ∟.

4. In an Isosceles, when the equal sides include a ∟, the other two upon the base are each of them $\frac{1}{2}$ ∟.

5. An ∠ of an Equilateral △ is $\frac{2}{3}$ ∟. For $\frac{1}{3}$ of 2 ∟s = $\frac{2}{3}$ ∟.

Schol.

Every Right-Lined Figure may be divided into so many △s, as it contains sides less two, and the ∠s of the △s shall make up the ∠s of the Figure. Hence.

All the ∠s of a Right-Lined Figure together, make twice as many ∟s, bating four, as the Figure hath sides; and consequently all Right-Lined Figures, of the same species have the sums of their ∠s equal.

Theorem 23.

Prop. XXXIII.

If two equal and parallel lines A B, C D *be joyned together with two other Right-Lines* A C, B D, *then are those lines also equal and parallel.*

Pro. DRaw the Right-Line *D A*. Now because *A B*, and *C D* are
(a) 29. 1. parallel, and the ∠ *D A B* [a] = *A D C*; and also by Hyp. *A B*
(b) 4. 1. = *C D*, and the side *A D* common, therefore is *A C* [b] = *D B*, and the
(c) 27. 1. ∠ *C A D* [b] = *A D B*. [c] Whence also *A C* ∥ *D B*.

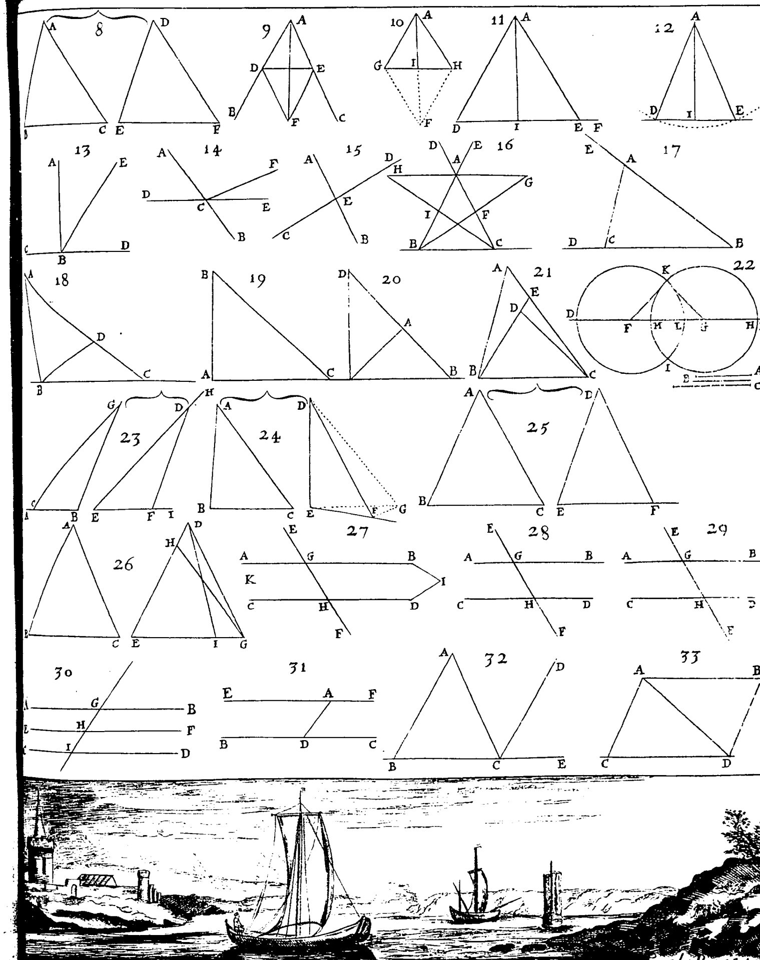
Theorem 24

Prop. XXXIV.

In Parallelograms as ABCD, *the opposite sides are equal viz.* A B = C D, *and* A C = B D, *as also the opposite* ∠s, A = D, *and* B = C; *and the Diameter* A D, *bisects the same.*

(a) *hyp.* *Pro.* A *B* [a] ∥ *C D* [b] therefore the ∠ *B A D* = *C D A*, and because also
(b) 29. 1. *A C* [a] ∥ *B D*, [b] therefore is the ∠ *C A D* = *A D B* [c] therefore
(c) 2 *ax.* the

First Booke of Euclide.



Eucl: Page 40.

the whole ∠ $BAC = BDC$. After the same manner is $B = C$. Also because the alternate ∠[s] $BAD = ADC$, and $CAD = ADB$, [d] therefore is $AC = BD$, and AB [d] $= CD$, and also the △ ABD = △ ACD. *W W D.* (d) 26. 1.

Schol.

1. It's only the Parallelogram space, or area that is bisected or divided into two equal parts by the Diagonal AD, and not the ∠[s], unless where the sides be all equal as in the □ and ◇; in the ▭ and ▱, the ∠[s] are cut unequally, because of the inequality of the adjacent Sides.

2. Every Four sided Figure, $ABDC$, having the opposite ∠s equal, is a ▯.

Hence may be also learnt another Method, how to draw a parallel CD, to a Right-Line given AB, that shall pass through a point assigned C.

Take in the Line AB, two points EF. And with the Extent EC, setting one Foot in F, sweep the Arch RS, then with the Extent EF, setting one Foot in C, cross the said Arch in D: lastly, draw CD, and it shall be a parallel to AB, and pass through C.

Prop. XXXV. Theorem 25.

Parallelograms, DA, ED, *standing on the same base* DC, *and between the same parallels* AB, CD; *are equal one to the other.*

Pro 1. *Case.* AE [a] $= CD$ [a] $= EB$, and $AC = ED$; also the ∠ CAE [c] $= DEB$. therefore the △ CAE [e] = △ DEB, [f] also put the △ ECD common to both, then will the ▯ $AECD = CEBD$. *W W D.* (a) 34. 1. (c) 29. 1. (e) 4. 1. (f) 2 *ax.* (g) 3 *ax.*

2. *Case.* $AE = FB$ as before, [g] then taking from both the common segment FE, there remains $AF = EB$. Because AC [h] $= ED$, the ∠ A [i] $= E$, and consequently [k] the △ FAC = △ BED, to both which adding Trapezium $EFCD$ the ▯ $AECD$ [m] $= FBCD$. *W W D.* (h) 34. 1. (i) 29. 1. (k) 4. 1. (m) 2 *ax.* (p) 2 *ax.*

3. *Case.* Again, AE [a] $= CD = FB$; therefore AF [p] $= EB$. And forasmuch as AC [q] $= ED$, the ∠ E = [r] A; and consequently the △ ACF = [s] △ EDB. Lastly if from both there be taken the common △ EGF, the remaining Trapezium, $ACGE = FGDB$, to which if you add the common △ CGD, then shall the ▯ $AD = DF$. *W W D.* (q) 34. 1. (r) 29 1. (s) 4. 1.

Schol.

Hence, the Area of any ▯, is found by multiplying the Perpendicular height thereof by the base. As admit AB, be 4 Foot, and $BC = 3$; then $4 \times 3 = 12$ the Area, or number of square Feet (represented by the several squares in the Scheme) in that Parallelogram.

Theorem 26.

Prop. XXXVI.

Parallelograms AE, HD *upon equal bases* CE, FD, *and betwixt the same Parallels* AB, CD, *are equal one to the other.*

(a) 34. 1.
(b) 35. 1.

Pro. DRaw CH, and EB [a] which will be equal and Parallel, and consequently CB be a ▯, whence the ▯ $CG =$ [b] $CB = HD$. *W W D.*

Theorem 27.

Prop. XXXVII.

△s ACD, FCD *upon the same base* CD, *and between the same Parallels* AB, CD, *are equal one to the other.*

(a) 31. 1.
(b) 35. 1.
(c) 34. 1.
(d) 7 *ax.*

Pro. [a] THrough D, draw $DE \parallel CA$, and $DB \parallel CF$. Then is the ▯ $AD =$ [b] ▯ CB, [c] and consequently their halfs, the △ $ACD =$ [d] FCD. *W W D.*

Theorem 28.

Prop. XXXVIII.

△s ACE, BFD *upon equal bases* CE, FD, *and between the same Parallels* AB, CD *are equal one to the other.*

(a) 31. 1.
(b) 36. 1.
(c) 34. 1.
(d) 7 *ax.*

Pro. [a] DRaw $EG \parallel AC$, and $FH \parallel BD$. Then will the [b] ▯ $CG =$ ▯ HD, and the △ $ACE =$ [c] $\frac{1}{2}$ ▯ $CG =$ [d] $\frac{1}{2}$ ▯ $HD =$ [c] △ BFD. *W W D.*

Schol.

1. If the base CE, be greater than FD, then is the △ ACE ⊏ BFD, and the contrary.

2. Also a Right-Line, being drawn from the vertical ∠ of any Right-Lined △ to the base, shall divide the Area according to the base, as if it bisect the base, the △ shall be divided in respect of Area, into two equal parts *&c.*

Prop.

Prop. XXXIX.

Theorem 29.

Equal △s BCA, BCD *upon the same base* BC, *and on the same side, are also between the same Parallels* AD, BC.

Pro. IF not, draw $AE \parallel BC$; and joyn CE. Then is the △ CBE [a] $= C$ BA [b] $= CBD$, [c] which is absurd.

(a) 37. 1.
(b) *hyp.*
(c) 9 *ax.*

Prop. XL.

Theorem 30.

Equal △s BCA, EFD *upon equal bases* BC, EF, *and on the same side, are also betwixt the same Parallels.*

Pro. IF not, draw $AH \parallel BF$, and joyn FH. Then is the △ EFH [a] $=$ BCA [b] $= EFD$, [c] which is absurd. The like will follow for AG.

(a) 38. 1.
(b) *hyp.*
(c) 9 *ax.*

Prop. XLI.

Theorem 31.

If a ▯ AECD, *have the same base* CD *with the* △ FCD, *and be between the same Parallels* AF, CD: *then is the* ▯ *double to the* △.

Pro. DRaw AD. Then is the △ ACD [a] $=$ △ FCD. Therefore is the ▯ CE [b] $= 2CDA$ [c] $= 2CDF$. *W W D.*

(a) 37. 1.
(b) 34. 1.
(c) 6 *ax.*

Corol.

Hence, is the Area of a △ found by multiplying the ⊥ in the $\frac{1}{2}$ base, or the whole base in the $\frac{1}{2}$ ⊥. As admit, the height or ⊥ be 6 and the $\frac{1}{2}$ base 5; then $6 \times 5 = 30$ the Area, or $10 \times 3 = 30$ the Area.

Prop. XLII.

Problem 11.

To make a ▯ FC, *equal to a* △ *given* ABC, *in an* ∠ *equal to a Right-Lined* ∠ *given* D.

Pra. THrough A, [a] draw $AG \parallel BC$, and [b] bisect the base BC in E, [c] make the ∠ $BCG = D$, and draw $EF \parallel CG$, which resolves the Problem.

Pro. For AE being drawn, the ∠ $ECG = D$ by constr. and the △ BAC [d] $= 2AEC$ [e] $=$ ▯ $ECGF$. *W W Dn.*

(a) 31. 1.
(b) 10. 1.
(c) 23. 1.
(d) 38. 1.
(e) 41. 1.

Prop.

Theorem 32.

Prop. XLIII.

In every ▯ ABCD, *the complements* DG, GB *of the* ▯ˢ HE, FI, *which ſtand about the Diameter, are equal one to the other.*

(a) 34. 1.
(b) 2 ax.
(c) 3 ax.
(d) 1 ax.

Pro. FOr the $\triangle ACD$ [a] $= ACB$, and the $\triangle AGH$ [a] $= AGE$, and the $\triangle GCF$ [a] $= GCI$, [b] and $\triangle AGE + GCI =$ [b] $AGH + GCF$. [c] Therefore $ACD - \overline{AGH + GCF} =$ ▯ $DG = ACB - \overline{AGE + GCI} =$ ▯ GB, and conſequently the [d] ▯ $DG = GB$. *WWD.*

Problem 12.

Prop. XLIV.

To a Right-Line given F, *to make a* ▯ CM, *at a Right-Lined* ∠ *given* D, *equal to a given* △ ABC.

(a) 42. 1.
(b) 31. 1.

Pra. [a] MAke a ▯ $CG = \triangle ABC$, having its $\angle GEC = D$. Produce EC till $CK =$ the given Line F, through K [b] draw $MI \parallel CH$, meeting GH produced in I, then from I draw by C the diameter IC meeting, (when produced,) GE in L, through L [b] draw $LM \parallel EK$, which let HC produced meet at N, then ſhall CM be the ▯ required.

(c) 43. 1.
(d) 28. 1.
(e) 27. 1.

Pro. For the ▯ CM [c] $=$ ▯ $CG = \triangle ABC$, [d] and the $\angle CNM = \angle HCK =$ [e] $\angle GEC = D$. *WWDn.*

Problem 13.

Prop. XLV.

Upon a Right-Line given FG, *to make a* ▯ FL, *equal to a Right-Lined Figure given* AC, *at a Right-Lined* ∠ *given* E.

(a) 44. 1.
(b) 15. ax.
(c) conſtr.

Pra. REduce the given Right-Lined Figure into △ˢ BAD, BCD, then [a] make a ▯ $FH = \triangle BAD$ and having an $\angle F = E$, FI being produced, [a] make on HI the ▯ $IL = \triangle BCD$. Then is the ▯ FL [b] $= FH + IL$ [c] $= AC$. *WWDn.*

Schol.

Hence is conſpicuous a method of Reducing Figures, to ▯ˢ of equal baſes or heights.

Problem. 14.

Prop. XLVI.

Upon a Right-Line given AB, *to deſcribe a Square* ABCD.

(a) 11. 1.
(b) 3. 1.

Pra. [a] ON A and B, Raiſe 2 ⊥ˢ AC, BD, [b] each equal to the given Line AB; then joyn CD, and the thing required is done.

Pro.

(c) conſtr.
(d) 28. 1.
(e) conſtr.
(f) 34. 1.
(g) 29. def.

Pro. For, ſeeing the ∠ˢ $A + B$ [c] $=$ 2 ∟ˢ, therefore [d] $AC \parallel BD$, [e] and they are alſo equal, therefore the Figure AD, is a [f] Right-Angled Equilateral ▯, [g] and conſequently a Square. *WWDn.*

After the ſame manner may an Oblong, or a long Square be deſcribed, with two given Lines.

Prop. XLVII.

Theorem 33.

In any Right-Angled △ BAC, *the Square* BD, *which is made of the ſide* BC, *that ſubtends the* ∟ BAC, *is equal to both the Squares* BG, CH, *which are made of the ſides* AB, AC, *containing the* ∟.

(a) 10 ax.
(b) 29 def.
(c) 4. 1.
(d) 41. 1.
(e) 6 ax.
(f) 1 ax.
(g) 15 ax.
Pythagoras Samius.

Pra. IOyn AE, and AD; and draw $AL \parallel BE$, alſo draw BI and CF. *Pro.* Becauſe the $\angle DCB$ [a] $= ICA$, and the $\angle ACB$ common, the $\angle ACD = ICB$. Alſo becauſe AC [b] $= CI$, and CD [b] $= BC$; [c] therefore is the $\triangle ACD = \triangle ICB$. But the ▯ CL [d] $= 2\,ACD$, and the ▯ [d] $CH = 2\,ICB$, (for [d] HAB is a Right-Line,) [e] therefore is the ▯ $CL =$ ▯ CH. By like reaſon is $2\,\triangle ABE =$ ▯ $BL = 2\,\triangle FBC =$ ▯ BG, and [f] conſequently ▯ $BL =$ ▯ BG. [g] Therefore is the whole □ $BD =$ ▯ $CL +$ ▯ $BL =$ □ $CH +$ □ BG. *WWD.*

Schol.

Hence we have a method of Adding, and Subtracting Squares, which ſhall be farther illuſtrated in the two Problems following.

Problem I.

Andr. Tacquet.

To make a Square equal to any Number of given Squares.

(a) 11. 1.
(b) 47. 1.
(c) 2 ax.

Pra. LEt a, b, c, be the ſides of the three □ˢ, [a] Make the ∟ ABC, laying a from B to C, and b from B to D and draw DC, then is DCq [b] $= BCq + BDq = a^2 + b^2$.
Then transfer DC from B to E, and lay C from B to F, drawing EF, then is FEq [c] $= BEq\ (DCq) + BFq\ (c^2) = a^2 + b^2 + c^2$. *WWDn.*

Problem II.

To make a □ *equal to the difference of* 2 □ˢ *given.*

(a) 47. 1.
(b) 3 ax.

LEt a, b be the ſides of the 2 □ˢ given. Draw the indeterminate line AD, then transfer a from A to B, and b from B to C, and with the extent AB from the Center B, [a] deſcribe a ○; and from the point C, raiſe the ⊥ CE, cutting the circumference in E; laſtly, draw BE. [a] Then is $BEq = BAq = a^2 = BCq\ (b^2) + ECq$. [b] Therefore $BAq - BCq = a^2 - b^2 = CEq$. *WWDn.*

Problem III.

Problem III.

Any two sides of a Right-Angled △ a, b, c *being given to find the third.*

IF the two sides containing the ∟ be given, *viz.* a, b: then $a^2 + b^2 = c^2$, and $\surd: \overline{a^2 + b^2} := c$. In Numbers thus, let $a = 9$, $b = 12$, then $a^2 = 81$, and $b^2 = 144$, and $a^2 + b^2 = 225$. And $\surd: \overline{a^2 + b^2} = 15 = c$. But if the side c, subtending the ∟ be one of the sides given, then $c^2 - b^2 = a^2$, and $\surd: \overline{c^2 - b^2} := a$ In Numbers thus, $c^2 = 225$, $b^2 = 144$, and $c^2 - b^2 = 81$, also $\surd: \overline{c^2 - b^2} := 9 = a$. *WWDn.*

And Note, that the Numbers 3, 4, and 5 (to which we may add all their multiplices and powers) are called Pythagoric Numbers, and do compleatly constitute Right-Angled △s if put for sides.

Theorem 38.

Prop. XLVIII.

If the Square made upon one side BC, *of a* △ CAB, *be equal to the Squares made on the other side of the* △, AB, AC, *then the* ∠ CAB *contained under the other two sides* AB, AC *is a* ∟.

(a) 11. 1.
(b) *constr.*
(c) 47. 1.
(d) *hyp.*
(e) 1 *ax.*
(f) 8. 1.

Pra.[a] FRom the point *A*, draw $AD = AC$, so that $AD \perp AB$, and joyn *DB*.

Pro. Then because [b] *DAB* is ∟, DBq [c] $= ABq + ADq$, and because [d] $CBq = CAq + ABq$, [e] therefore $CB = BD$. And so the △s *CAB*, and *ADB* are mutually Equilateral, and also [f] the ∠s correspondent to the equal sides equal. But *DAB* is ∟, therefore *CAB* shall also be ∟. *WWD.*

The most notable and useful Propositions of this Book are the, 4, 5, 6, 13, 15, 18, 19, 20, 26, 29, 31, 32, 36, 37, 38, 41, 47.

THE SECOND BOOK OF Euclid's Elements.

DEFINITIONS.

1. EVery Right-Angled ▯ *ABCD*, is said to be contained under two Right-Lines *AB*, *BD* comprehending a ∟.

But for ease sake we express ▭ *CA*, *AB*, or ▭ *CAB* or ▭ *AD* or $CA \times AB$, (or by marking each side with a single letter) *a b*, still understanding thereby the rectangle or oblong, contained under the Right-Lines *CA*, *AB* set at Right-Angles.

2. In every ▯ *AD*, any one of those ▯s which are about the Diameter, together with its two complements, is called a Gnomon, as the ▯ $GE + AC + EH$ or *ABH* is a Gnomon; as also $FH + AC + CD$ or *GLE* is a Gnomon.

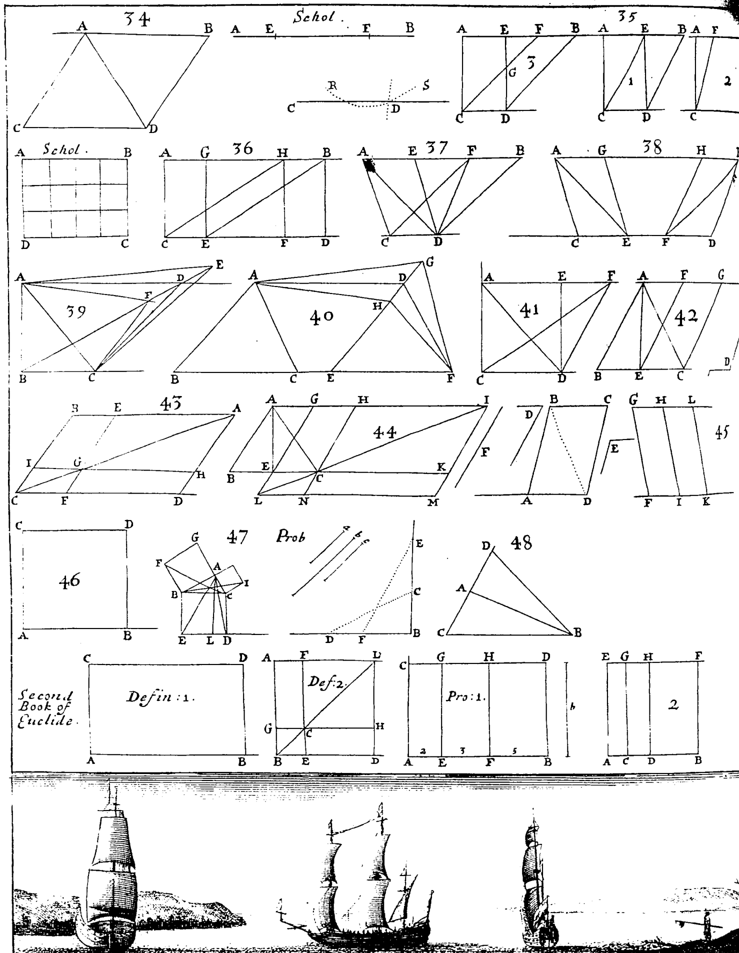
Very easie Equations, arising by comparing of two unequal Quantities or Numbers: whereby most of the Propositions of the Second Book are invented, found out and wrought, fit to exercise the young Student withall. Let the Quantities be m (7), n (3), *the sum* z (10), *Difference* x (4.)

The Reason.	Numbers of Equations.	*In Species*	*In Numbers.*
	1	$z=m+n$	$10=7+3$
	2	$x=m-n$	$4=7-3$
$1-n$	3	$m=z-n$	$7=10-3$
$1-m$	4	$n=z-m$	$3=10-7$
$2+n$	5	$m=x+n$	$7=4+3$
$2-x$	6	$n=m-x$	$3=7-4$
$1+2$	7	$2m=z+x$	$14=10+4$
$1-2$	8	$2n=z-x$	$6=10-4$
$7 \div 2$	9	$m=\frac{z+x}{2}$	$7=\frac{10+4}{2}$
$8 \div 2$	10	$n=\frac{z-x}{2}$	$3=\frac{10-4}{2}$
$7-x$	11	$z=2m-x$	$10=14-4$
$7-z$	12	$x=2m-z$	$4=14-10$
$8+x$	13	$z=2n+x$	$10=6+4$
$13-2n$	14	$x=z-2n$	$4=10-6$
$2 \times x$	15	$x^2=xm-xn$	$16=28-12$
3×4	16	$mn=z^2+mn-zm-zn.$	
5. Q	17	$m^2=x^2+2xn+n^2.$	

The Reason.	Numbers of Equations.	*In Species.*	
$1 \times b$	18	$zb=bm+bn$	(1 Prop.)
$1 \times z$	19	$z^2=zm+zn$	(2 Prop.)
$1 \times m$	20	$zm=m^2+mn$	(3 Prop.)
$1 \times n$	21	$zn=n^2+mn$	
1. Q.	22	$z^2=m^2+2mn+n^2$	(4 Prop.)
2 Q	23	$x^2=m^2-2mn+n^2$	
7×8	24	$4mn=z^2-x^2$	
$24 \div 4$	25	$mn=\frac{z^2}{4}-\frac{x^2}{4}$	
$25+\frac{x^2}{2}$	26	$mn+\frac{x^2}{4}=\frac{z^2}{4}$	(5 Prop.)
1×2	27	$zx=m^2-n^2$	
$27+n^2$	28	$zx+n^2=m^2$	(6 Prop.)
3. Q.	29	$m^2=z^2-2zn+n^2$	
$29+2zn$	30	$2zn+m^2=z^2+n^2$	(7 Prop.)
$24+x^2$	31	$4mn+x^2=z^2$	(8 Prop.)
$22+23$	32	$z^2+x^2=2m^2+2n^2$	(10 Prop.)
$32 \div 2$	33	$\frac{z^2+x^2}{2}=m^2+n^2$	(9 Prop.)
		and so infinitely.	

The 16 Equation, and so to the 33 will prove true if put into Numbers as the former were.

Prop.



Eucl. Page 49

Prop. I.

Theorem 1

If two Right-Lines b, *and* AB *be given, and one of them* AB *divided into as many parts as you please; the* $\square$ *comprehended under the whole* b, *and divided line* AB, *shall be equal to all the* $\square^s$ CE, EH, FD *contained under the whole line* b, *and the several segments* AE, EF, FB.

Pra. FRom the points A, B, [a] raise $AC, BD, \perp$s AB, making $AC = BD = b$, and joyn CD, then [b] draw through the points E and F, [c] $FH \parallel$ [c] $EG \parallel$ [c] AC, producing them till they meet with the Line CD. (a) 11. 1. (b) 30. 1. (c) 31. 1.

Pro. So is [e] CB a $\square$, under $AC\ (=b)$ and AB, and is [d] equal to the [e] $\square^s$ $CA + EH + HB$. *WWD.* (d) 15 *ax.* 1. (e) 34. 1.

In Numbers thus,

Let $b = 3$, and $AB = 10$, which 10 divide into $2 = AE$, $3 = EF$, and $5 = FB$. Then will $10 \times 3 = 30 = \overline{3 \times 2} + \overline{3 \times 3} + \overline{3 \times 5}$.

The 18 Equation, $zb = mb + nb$, in words thus, if two Right-Lines z and b be given, and if one z be divided into two parts (or as many as you please) $m + n$, the Rectangle of those two lines zb is equal to the Parallel Rectangles $mb + nb$, made of the line b and the Segment of z, viz. m and n.

Prop. II.

Theorem 2.

If a Right-Line AB, *be divided any wise in* C *and* D, *the Rectangles* EC, GD, HB, *comprehended under the whole line* AE, (= AB) *and each of the Segments* AC, CD, BD, *are equal to the Square* AF, *which is made of the whole line* AB. *That is,*
$\overline{AB \times AC} + \overline{AB \times CD} + \overline{AB \times DB} = ABq.$

Pra. ON AB make the [a] $\square\ EB$, and through C and D let be drawn [b] CG, and $DH \parallel AE$; [c] also let $CG = DH = AE$. Then shall the $\square\ EC = AE\ (=^{d} AB) \times AC$, the $\square\ GD = CG\ (= AB) \times CD$, and the $\square\ HB = DH\ (= AB) \times DB$. Therefore $\square\ EC + \square\ GD + \square\ HB = ABq$. *WWD.* (a) 46. 1. (b) 31. 10. (c) 3. 1. (d) 29 *def.* 1.

In Numbers.

Let $AB = 10$, $AC = 2$, $CD = 3$, $DB = 5$. Then $\overline{10 \times 5} + \overline{10 \times 3} + \overline{10 \times 2} = 10 \times 10 = 100$.

The 19 Equation, $z^2 = zm + zn$, in words, the Square of any line is equal to the Rectangle of that line and its parts.

Theorem 3.

Prop. III.

If a Right-Line AB, *be cut any wise in* E, *the Rectangle* CB, *comprehended under the whole line* AB, *and one segment* AC = AE, *is equal to the Rectangle* FB, *contained under* BE, FE (= AE) *and the Square* CE, *which is described on the segment* AE. *That is,* $\overline{AB \times AE} = \overline{EB \times AE} + AEq$.

(a) 11. 1.
(b) 3. 1.
(c) 33. 1.
(d) constr.
(e) 15 ax.

Pro. LEt AB, be divided in E, then on the points A, E, B [a] raise $AC, EF, BD \perp^s AB$, [b] and make $AC = EF = BD = AE$, also draw CD [c] $\parallel AB$. Then because $AC =$ [d] AE, the ▭ $AD = AB \times AE$: Again, because FE [d] $= AE$, therefore the ▭ $FB = BE \times AE$. Lastly, because $AC = EF = AE$, the ▭ AF is a Square, and the $\square$ $AF +$ ▭ $FB =$ [e] ▭ AD. *WWD.*

In Numbers.

Let $AB = 10$, $AE = 7$, and $EB = 3$. Then $\overline{7 \times 7} + \overline{7 \times 3} = \overline{7 \times 10} = 70$.

The 20 and 21 Equations, $zm = m^2 + mn$ &c. in words, the Rect-Angle under the whole line z, and one of its parts m, is equal to the Square of one part m^2 and the ▯ of the part mn.

Theorem 4.

Prop. IV.

If a Right-Line AB *be cut any wise in* C, *the Square* AE, *which is made of the whole line* AB, *shall be equal to the Squares* HF, CK, *which are described on the segment* AC, CB, *and to double the* ▭ *contained under the segment* AC CB, *sci. the* ▭s AG, GE. *That is,* $ABq = ACq + CBq + \overline{2\,AC \times CB}$.

(a) 5. 1.
(b) 32. 1.
(c) 29. 1.
(e) 6. 1.
(f) 34. 1.
(g) 29 def.
(h) 15 ax.

Pro. IN the $\triangle ABD$, because $AD = AB$, therefore the $\angle ADB =$ [a] $\angle ABD =$ [b] $\frac{1}{2}$ ∟. The same may be said of the $\triangle EBD$. Also in the $\triangle FDG$, the $\angle DFG$ is [c] ∟, and $FDG = FGD =$ [b] $\frac{1}{2}$ ∟, therefore [e] $DF = FG =$ [f] $DH =$ [f] HG, and the ▯ FH is [g] a $\square$. For the same reason shall the ▯ CK be a $\square$. Therefore HF, CK are the $\square$s of the segment $AC (= HG)$, CB. Again, seeing $CG = GK =$ [g] CB, and $FG = GH = AC$ the ▭s AG, GE are contained under the segments AC, CB: And lastly, the $\square$ AE [h] $= \square$s $HF + CK +$ ▭s $AG + GE$, or ABq [h] $= ACq + CBq + 2\,AC \times CB$. *WWD.*

Corol.

The ▯s about the Diameter of a $\square$ are $\square$s

In Numbers.

Let $AB = 6$, $AC = 4$, and $CB = 2$. Then $ABq = 36$, $ACq = 16$, $CBq = 4$, and $AC \times CB = 8$, and lastly, $36 = 16 + 4 + \overline{2 \times 8}\ (= 16.)$

Or Thus.

$\square AE = 36$, $\square HF = 16$, $\square CK = 4$, ▭ $AG = 8$, ▭ $GE = 8$. Then $\square 36 = \square 16 + \square 4 + 8 + 8$.

The 22 Equation, $z^2 = m^2 + 2mn + n^2$, in words, the Square of the whole line, is equal to both the Squares made of the segment, and twice their ▯.

Theorem 5.

Prop. V.

If a Right-Line AB, *be cut into equal parts in* C, *and unequal in* D, *the Rectangle* LD, *under the unequal parts* AD, DG (= DB) *together with the Square* HF, *which is made of the intermediate distance of the sections* CD, *is equal to the Square of the half line* CB. *That is,* $CBq = \overline{AD \times DB} + DCq$.

(a) 46. 1.
(b) 31. 1.
(c) 43. 1.
(d) cor. pre.
(e) 36. 1.
(f) ax. 1. 1.
(g) cor. preceding.

Præ. ON CB [a] make the $\square CI$, and draw its diameter EB, also through [b] D draw $DF \parallel BI$; and taking $BK = DB$, draw likewise through K the line $KL \parallel AB$, also $AL \parallel BK$.

Pro. The ▭ CG [c] $=$ ▭ GI, and putting the [d] $\square DK$ common, the ▭ $CK =$ ▭ DI. But AH [e] $= CK$ [f] $= DI$. If therefore CG be put common, ▭ $AG = IGC$. Wherefore seeing the Gnomon $IGC +$ [g] $\square HF = CI$, the ▭ $AG + \square HF = \square CI$. *WWD.*

In Numbers.

Let $AB = 10$, $AC = CB = 5$, $AD = 7$, $DB = 3$. Then $\overline{7 \times 3} + \overline{2 \times 2} = 5 \times 5$, that is, $21 + 4 = 25$.

The 26 Equation, $mn + \frac{x^2}{4} = \frac{z^2}{4}$ That is, in words, the Rectangle of the unequal segments, together with the Square of the half difference, is equal to the Square of half the sum; now to prove that the intermediate distance CD is equal $\frac{x}{2}$, the 13 Equation proves $z = 2n + x$. The half whereof is $\frac{z}{2} = n + \frac{x}{2}$, now $DB = n$, Therefore $CD = \frac{x}{2}$.

Theorem 6.

Prop. VI.

If a Right-Line AB, *be divided into two equal parts in* C, *and another Right-Line* BD, *added to the same directly in one Right-Line, the Rectangle* AI, *comprehended under the whole* AB, *more the augment* BD, *and the augment* DI (=BD,) *together with the Square of the half* KH (=CB) viz. KG, *is equal to the Square* CE *made on* CD=CB+BD, *taken as one line. That is,* $\overline{AD \times DB} + CBq = CDq$.

(a) 46. 1. (b) 31. 1. *Præ.* ON the Right-Line CD [a] make the $\square CE$, through B, draw BG [b] $\parallel DE$, and taking $DI = DB$ draw through I, $IL \parallel DA$, and also $AL \parallel DI$.

(c) 36. 1. (d) 45. 1. (e) 15 *ax.* *Pro.* The $\square^s\ LC =^c KB =^d HE$, and putting $CHBI$ common, the Gnomon $EHC = AI$. But $EHC + \square KG =^e \square CE$: Therefore $\square AI + \square KG = \square CE$. *WWD.*

In Numbers.

Let $AB = 10$, $AC = CB\ 5$, $BD = 2$, $AB + BD = 12$, $CB + BD = 7$. Then $12 \times 2 + 5 \times 5 = 7 \times 7$, that is, $24 + 25 = 49$.

Coral.

If 3 Right-Lines BD, $CB + BD$, $AB + BD$, be in arithmetical proportion, then the Rectangle under the extremes, together with the Square of the difference, is equal to the Square of the middle term, that is, $AD (= AB + BD) \times BD, + BCq = Q : CD = Q : \overline{CB + BD}$.

The 28 Equation, $zx + n^2 = m^2$, putting $CD = m$, $AC = n$, and $BD = x$, in words, it will make this proposition.

Theorem 7.

Prop. VII

If a Right-Line AB, *be cut any wise in* C, *the Squares of the whole line, together with the Square of one of the segments* CB, *is equal to the double Rectangle under the whole line* AB, *and the said segment* CB, *together with the Square made of the other segment* AC. *That is,* $ABq + CBq = 2\,\overline{AB \times CB} + ACq$.

(a) 46. 1. (b) 2 *ax.* (c) *constr.* (d) 15 *ax.* 1. *Præ.* ON AB [a] make the $\square AE$, and taking $BM = CB$, draw $CL \parallel BE$, and $MK \parallel AB$, and produce BE to G, so that $EG = BM$, and $MG =^b BE$ and compleat the $\square EF$.

Pro. Then, $\square AE +^c EF =^d \square AM + MF + KL$. *WWD.*

In

In Numbers.

Let $AB = 10$, $AC = 7$, $CB = 3$, and $ABq = 100$, $CBq = 9$, $ACq = 49$, $AB \times CB = 30$. Then $100 + 9 = 30 \times 2 + 49$.

The 30 Equation $2zn + m^2 = z^2 + n^2$, in words, &c.

Prop. VIII.

Theorem 8.

If a Right-Line b *be cut any wise into two parts, the quadruple Rectangle under the whole line* b, *and one of the segments* z, *together with the Square of the other segment* y, *is equal to the Square of the whole line* b, *and segment* z, *taken as one line.*

	1	That is, $4bz + y^2 = Q : \overline{b + z}$.	
	2	For [a] $2bz + y^2 = b^2 + z^2$.	(a) 7. 2.
[b] 2 $- y^2$	3	$2bz = b^2 + z^2 - y^2$.	
[c] 3 $+ 2bz$	4	$4bz = b^2 + z^2 - y^2 + 2bz$.	(b) 3 *ax.* 1.
[b] 4 $+ y^2$	5	$4bz + y^2 = b^2 + z^2 + 2bz = Q : \overline{b + z}$. *WWD.*	(c) 2 *ax.* 1.

In Numbers.

Let $b = 10$, $y = 7$, $z = 3$, then $bz = 30$, and $4bz = 120$, $b^2 = 100$, $y^2 = 49$, $z^2 = 9$, $2bz = 60$, lastly, $120 + 49 = 100 + 9 + 60 = 169 = \overline{10 + 3} \times \overline{10 + 3}$.

The 31 Equation, $4mn + x^2 = z^2$, in words, &c.

Prop. IX.

Theorem 9.

If a Right-Line AB, *be cut into unequal parts in* D, *and equal in* C, *then are the Squares of the unequal parts* AD, DB *together, double to the Square of the half-line* AC, *and to the Square of the difference* CD. *That is,* $ADq + DBq = 2\,ACq + 2\,CDq$.

Præ. FRom C, raise $CE \perp$, and $= CA = CB$, and draw EA, EB, also through D, draw $DF \parallel CE$, and through F, $GF \parallel CD$, and lastly, joyn AF.

Pro. The $\triangle ACE$ is an [a] Isosceles, therefore the $\angle A = \angle^b E =^c \frac{1}{2}\,\llcorner$. (a) *constr.*
Also in the $\triangle BCE$, for the same reason, the $\angle B = \angle E = \frac{1}{2}\,\llcorner$; therefore (b) 5. 1.
the whole $\angle AEB$ is $\llcorner$. In the $\triangle EGF$, the $\angle G^d = \angle ECB =^a \llcorner$, (c) 32. 1.
therefore the $\angle E =^b F =^c \frac{1}{2}\,\llcorner$, and consequently, $GE =^e GF$. Whence (d) 29. 1.
$GF =^f CD = GE$, and by like reason shall $DF = DB$. Now $AFq^g =$ (e) 6. 1.
$ADq + DFq\ (= DBq;)$ again $AFq^g = AEq + EFq$. But $AEq =$ (f) 34. 1.
$ACq + CEq = 2\,ACq$. And $EFq = EGq + GFq = 2\,GFq =$ (g) 47. 1.
$2\,CDq$. Wherefore $ADq + DBq = 2\,ACq + 2\,CDq$. *WWD.*

In

In Numbers.

Let $AD=7$, $DB=3$, $AC=5$, and $CD=AD-AC=2$, $ADq=49$, $DBq=9$, $ACq=25$, $CDq=4$. Then $49+9=\overline{25\times 2}+\overline{4\times 2}$, that is, $49+9=50+8=58$.

The 33 Equation, $\frac{z^2+x^2}{2}=m^2+n^2$, in words, &c.

Prop. X.

Theorem 10.

If a Right-Line AB, *be cut into two equal parts in* C, *and another line* BO, *be added in a Right-Line with the same, then is the Square of the whole line and augment taken as one line, together with the Square of the said augment* BO, *double of the Square of the half* CB, *and augment* BO, *taken as one line. That is,* AOq + BOq = 2 BCq + 2 COq.

Pre. FRom C, raise $CE \perp$ and $= AC$, and draw AE, EB; also through E, draw $EF \parallel CO$, and through O, $OF \parallel CE$, produce FO, till it meet EB produced in G, and draw AG.

(a) 6. 1.
(b) 47. 1.

Pro. In the $\triangle$s ACE, ECB, $AC=EC=CB$, also in the $\triangle$s EFG and BOG, $FE=FG$, and $BO={}^{a}GO$, and consequently the $\angle FEG=FGE=GBO=\frac{1}{2}\llcorner$, and the $\angle BEC=EBC=CEA=EAC=\frac{1}{2}\llcorner$. Then $AGq={}^{b}AOq+OGq\ (=BOq,)$ and $AGq=AEq+EGq$. But $AEq=2ACq$, and $EGq=2EFq=2FGq$. Therefore $AOq+BOq=2ACq+2COq$. *WWD.*

In Numbers.

Let $AB=10$, $AC=CB=5$, $BO=3$, $AO=BA+BO=13$, $CO=8$, $ABq=100$, $BOq=9$, $\overline{AB\times BO}=30$, Then $169+9=\overline{8\times 8\times 2}+\overline{5\times 5\times 2}=178$.

The 32 Equation, $z^2+x^2=2m^2+2n^2$, in words, &c.

Problem 1.

Prop. XI.

To cut a Right-Line given AB *in* G, *so that the Rectangle under the whole line* AB, *and one of the segment* BG, *shall be equal to the Square of the other segment* AG.

(a) 46. 1.
(b) 10. 1.

Pra. UPon AB [a] describe the $\square AC$. [b] Bisect the sides AD in E, and draw EB, the line EA being produced, make $EF=EB$, on AF make the $\square AH$, extending the side GH to I, then is the $\square AH = AB \times BG$.

Pro.

Pro. For $\square FI+EAq\ {}^{c}=EFq\ {}^{d}=EBq\ {}^{e}=BAq+EAq$: therefore $\square FI\ {}^{f}=BAq=\square AC$. Then take away the common $\square AI$, and there remains $AH=GC$, that is, $AGq=AB\times BG=\square GC$. *WWD.*

(c) 6. 2.
(d) constr.
(e) 47. 1.
(f) 3 ax.

Schol.

This Prop. * cannot be performed by Numbers. * 6. 3.

Prop. XII.

Theorem 11.

In obtuse angled $\triangle$s ABC, *the Square of the side* AC, *subtending the obtuse* $\angle$ B, *is greater than the Squares of the sides* BC, BA *containing the obtuse* $\angle$, *by a double Rectangle under the side* BC, *and segment of the continued Base* BD, *taken without the* $\triangle$ *from the point on which the Perpendicular* AD *falls, to the obtuse* $\angle$ B. *That is,* $CAq \sqsubset CBq + ABq$ *by* $2\,\overline{CB \times BD}$.

	1	*Pro.* [a] C $Dq = DBq + BCq + 2\,\overline{DB\times BC}$.
$1 + DAq$	2	[b] $CDq+DAq=DBq+BCq+2\,\overline{DB\times BC}+ADq$.
	3	But [b] $ACq=CDq+DAq$.
$3=2$	4	$ACq=DBq+BCq+2\,\overline{DB\times BC}+ADq$.
	5	And [b] $ABq=BDq+DAq$.
[c] 4 aliter	6	Therefore $ACq=CBq+BAq+2\,\overline{CB\times BD}$.
	7	And consequently $ACq \sqsubset CBq+BAq$ by $2\,\overline{CB\times BD}$. *WWD.*

(a) 4. 2.
(b) 47. 1.
(c) 3 ax.

Or thus Lettering the Scheme as in the Margin.

	1	$b^2 \sqsubset c^2+d^2$ by $2cy$, or $b^2=c^2+d^2+2cy$.
	2	$b^2={}^{a}s^2+z^2$.
	3	But $s^2={}^{b}y^2+2yc+c^2$.
2 aliter	4	$b^2=y^2+2yc+c^2+z^2$.
	5	$d^2={}^{a}y^2+z^2$.
$4-5$	6	$b^2-d^2=2yc+c^2$.
$6+d^2$	7	$b^2=d^2+c^2+2yc$. *WWD.*

(a) 47. 1.
(b) 4. 2.

In Numbers.

Let $b=10$, $d=7$, $c=5$, $y=2.6$, then is, $b^2=100$, $d^2=49$, $c^2=25$, $y=6.76$ $2cy=26$, and $d^2+c^2=49+25=74$. And lastly, $100=25+49+26$.

H *Schol.*

Schol.

Hence, the ſides of any obtuſe angled △ being known, the ſegment y intercepted between the ⊥ z and the obtuſe ∠, as alſo the ⊥ it ſelf z may
(c) 47. 1. eaſily be found, thus $\frac{b^2 - \overline{c^2 + d^2}}{2c} = y$, then [c] $\sqrt{:d^2 - y^2:} = z$. Thus explicated with the former Numbers, $100 - \overline{25 + 49} = 26$, then $\frac{26}{10} = 2.6 = y$. Alſo $49 - 6.76 = 42.24$, and $\sqrt{42.24} = z$.

Theorem 12.

Prop. XIII.

In an acute angled △ ABC, *the Square of the ſide* AB *ſubtending the acute* ∠ C, *is leſs than the Squares of the ſides* AC, CB *comprehending the acute* ∠, *by a double Rectangle under one of the ſides containing* (viz. BC *on which the* ⊥ *falls*) *and the line* DC, *taken within the* △ *from the* ⊥ *to the acute* ∠ C. *That is*, $BAq \sqsupset ACq + CBq$ *by* $\overline{2BC \times CD}$, *or* $BAq + \overline{2BC \times CD} = ACq + CBq$.

(a) 7. 2.		1	*Pro.* $BCq + DCq$ [a] $= BDq + \overline{2BC \times CD}$.
	$1 + ADq$	2	$BCq + DCq + DAq = BDq + ADq + \overline{2BC \times CD}$.
(b) 47. 1.		3	$DCq + DAq$ [b] $= ACq$.
(c) 47. 1.		4	$BDq + ADq$ [c] $= BAq$.
	2, 3.	5	$BCq + ACq = BDq + \overline{ADq + 2BC \times CD}$.
	5, 4.	6	$BCq + ACq = BAq + \overline{2BC \times CD}$. W W D.

Or thus, marking the Scheme as in the Margin.

$b^2 \sqsupset c^2 + d^2$ by $2dy$. or $b^2 + 2dy = c^2 + d^2$.

(a) 7. 2.		1	$d^2 + y^2$ [a] $= z^2 + 2dy$.
	$1 + p^2$	2	$d^2 + y^2 + p^2 = z^2 + p^2 + 2dy$.
(b) 47. 1.		3	$y^2 + p^2$ [b] $= c^2$.
		4	$z^2 + p^2$ [b] $= b^2$.
	2, 3.	5	$d^2 + c^2 = z^2 + p^2 + 2dy$.
	5, 4.	6	$d^2 + c^2 = b^2 + 2dy$. W W D.

In Numbers.

Let $b = 13$, $c = 15$, $d = 14$, and $y = 9$, and $b^2 = 169$, $c^2 = 225$, $d^2 = 196$, $2dy = 252$, then $196 + 225 = 169 + 252 = 421$.

Corol.

Corol.

Hence, the ſides of an accute angled △ being know, the ſegment intercepted between the acute ∠ and ⊥ and as alſo the ⊥ may eaſily be found; thus, $\frac{\overline{c^2 + d^2} - b^2}{2d} = y$, then $\sqrt{:c^2 - y^2:} = p^2$.

Prop. XIV.

Problem 2.

To make a Square ML, *equal to a Right-Lined Figure given* A.

Pra. [a] MAke the ▭ $EC = A$, and producing DC, make $CF = CB$, (a) 45. 1.
[b] Biſect DF in G, and with the extent $GF = GD$ from G de- (b) 10. 1.
ſcribe the Circle FHD, producing CB till it touch the Circumference in (c) 46. 1.
H. Then ſhall $CHq =$ [c] □ $ML = A$. (d) *conſtr.*
Pro. For let GH be drawn. Then is A [d] $= EC$ [d] $= DC \times CF$ [e] $= GFq$ (e) 5. 2 & 3 ax.
$- GCq$ [f] $= HCq$ [d] $= ML$. W W D. (f) 47. 1. & 3 ax.

The moſt uſeful Prop. of this Book are the 4, 5, 6, 12, 13 and 14.

H 2 THE

THE

THIRD BOOK OF Euclid's Elements.

DEFINITIONS.

1. EQual ○s *AB, BC* are ſuch whoſe diameters are equal: or from whoſe centers *D* and *E*, Right-lines drawn *DF, EG* are equal.

2. A Right-line *AC* is ſaid to touch a ○, when touching the ſame, ſuppoſe in *B*, and being produced, it cutteth it not.

3. Circles are ſaid, to touch one the other, which touch, but cut not one the other.

4. In a ○ Right-lines *CK, AB* are ſaid to be equally diſtant from the center, when Perpendiculars *DF, DF* drawn from the center *D*, to them are equal; and that line *GH* is ſaid to be farther diſtant from it; on whom the greater Perpendicular *DI* falls.

5. A ſegment of a Circle *ACB* is a Figure contained under a Right-line *AB*, and a portion of the Circumference of a Circle *ACB*.

6. An

6. An $\angle$ of a ſegment *CAB*, is that $\angle$ which is contained under a Right-line *AB*, and an Arch of a Circle *CA*.

7. An $\angle$ *ABC*, is ſaid to be in a ſegment *ABC*; when in the Circumference thereof ſome point *B* is taken, and from it Right-lines *AB, CB*, drawn to the ends of the Right-line *AC*, which is the baſe of the ſegment, then the $\angle$ *ABC*, contained under the adjoyned lines *AB, CB*, is ſaid to be an $\angle$ in a ſegment.

8. But when the Right-lines *AB, AD*, comprehending the $\angle$ *DAB*, do receive any periphery of the Circle *BCD*, then the $\angle$ *DAB* is ſaid to ſtand upon that periphery.

9. A ſector of a Circle is when an $\angle$ *BAC*, is ſet at the center *A* of that Circle; *viz.* that Figure *BAC*, comprehended under the Right-lines *BA, AC* containing the $\angle$, and the part of the Circumference received by them *BC*.

10. Like ſegments of a Circle are *ABC, DEF*, which conclude equal $\angle$s *BAC, EDF*, or, in whom the $\angle$s *CBA, FED* are equal.

Prop. I. Problem 1.

To find the center F, *of a circle given,* ABC.

Pra. DRaw *AC*, [a] which biſect in *E*, and on *E* [b] raiſe *BD* $\perp$ *AC*, and biſect it in *F*; the point *F*, ſhall be the center. (a) 10. 1. (b) 11. 1.

Pro. If not, let *G* a point without *BD*, be the center (for it cannot be in the line *BD*, ſeeing that cannot be divided equally in any point but *F*;) let the lines *GA, GC, GE* be drawn. (c) 15 def 1. (d) 8. 1.

Now [c] $GA = GC$, and $AE = EC$ by conſtr. and *GE* is common; [d] therefore the $\angle GEA = GEC =$ [e] ∟, [f] therefore the $\angle GEC = FEC$. [g] Which is abſurd. (e) 10 def. 1. (f) 10 ax. (g) 9 ax.

Corol.

If a Right-line biſect at Right-angles, another Right-line in a Circle; the center ſhall be in the biſecting line.

Prop. II. Theorem 1.

If in the circumference of a Circle ABC, *any two points* A *and* C *be taken, the Right-line* AC, *which joyns thoſe two points ſhall fall within the Circle.*

Pro. IF not, let it fall without and *ADC*, be a Right-line. [a] Having found the center *E*, draw *EA, EC, ED*, and let *ED* cut the periphery in *B*. (a) 1. 3.

Now

(b) 15 def. 1. (c) 5. 1. (d) 16. 1. (e) 19. 1.

Now because in the Right-lined △ *EADC*, *EA* = [b] *EC*, the ∠ *EADC* = [c] *ECDA*. But the outward ∠ *ADE* ⊏ [d] *DCE* ⊏ *EAD*. Therefore *EB* [b] = *AE* ⊏ [e] *ED*, the part than the whole, which is absurd.

Therefore the Right-line from *A* to *C*, cannot fall without but within the Circle. *WWD*.

Corol.

If a Right-line touch a Circle, so that it cut it not, it touches but in one point.

Theorem 2.

Prop. III.

If in a Circle CBD, *a Right-line* CE, *drawn through the center* A, *bisect any other line* BD *not drawn through the center, it shall also cut it at Right ∠s: and if it cut it at Right-angles it shall also bisect the same.*

(a) hyp. (b) 15 def. 1. (c) 8. 1. (d) 10 def. 1. (e) hyp. & 10. ax. (f) 5. 1. (g) 26. 1.

Pre. From the Center *A* let *BA*, *DA* be drawn.

Pro. 1. Because *BF* = [a] *FD*, and *BA* = [b] *AD*, and *EA* is common: the ∠s *AFB*, [c] *AFD* = [d] ∟. *WWD*.

Pro. 2. Because *AFD* [e] = *AFB*, and the ∠ *ABF* [f] = *ADF*, and *AF* common; [g] therefore is *BF* = *FD* = ½ *BD*. *WWD*.

Corol.

In any Equilateral or Isosceles △, if a line drawn faom the vertical ∠ bisect the base, that line is Perpendicular to it. And on the contrary, a Perpendicular drawn from the vertical ∠ bisects the base.

Theorem 3.

Prop. IV.

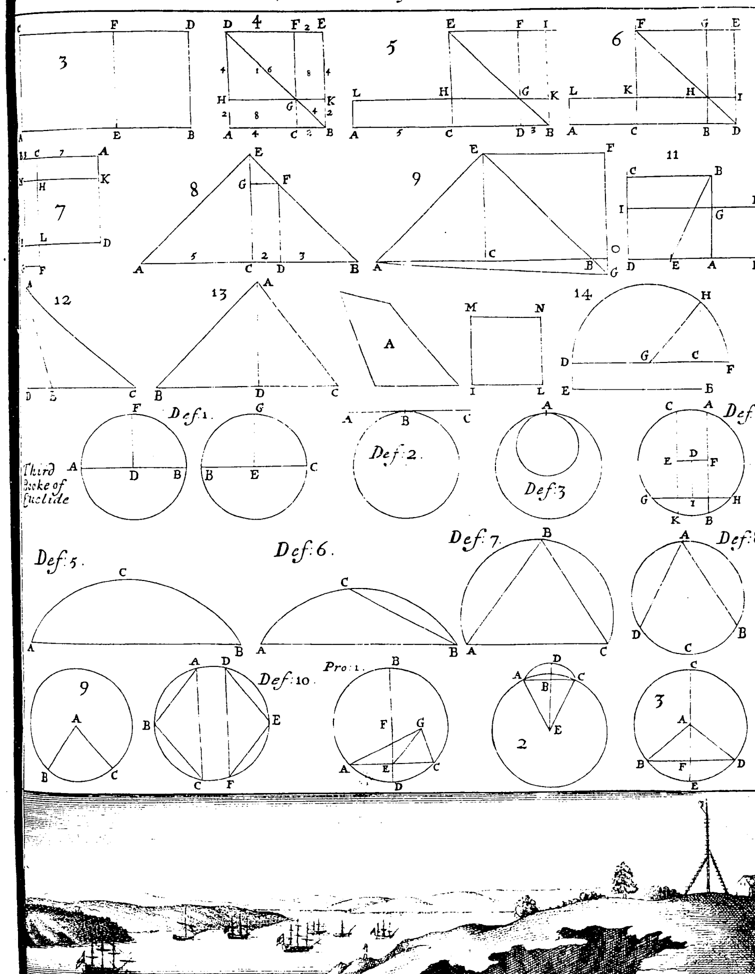
If in a Circle ADB, *two Right-lines* AB, CD *cut through one the other, yet neither of them pass through the Center* F, *then neither of those lines are divided into equal parts.*

Pro. For if one line only pass through the Center, its manifest that it cannot be bisected by the other.

(a) 9 ax. (b) 3. 3.

If neither of them pass through the Center, then from the Center *F* draw *FE*, now if *AB*, *CD*, were both bisected in *E*, the ∠ *FEB* = [a] *FEC* = [b] ∟. Which is absurd.

Prop.



Prop. V. Theorem 4.

If two ○s, DCB, ECB *cut one the other, they ſhall not have the ſame Center* A.

Pro. IF they have then AB[a] $=$ [a] $AD =$ [a] AE. [b] Which is abſurd.

(a) 15 *def.* 1.
(b) 9 *ax.*

Prop. VI. Theorem 5.

If 2 ○s, A B, C B *inwardly touch one the other in* B, *they have not one and the ſame Center* D.

IF they have, then DA[a] $= DB$ [a] $= CD$. [b] Which is abſurd.

(a) 15. *def.* 1.
(b) 9 *ax.*

Prop. VII. Theorem 6.

If in A B, *the Diameter of a* ○, *ſome point* G *be taken, which is not the Center of the* ○, *and from that point certain Right-lines* GC, GD, G E *fall on the* ○, *the greateſt line ſhall be that* GA *in which is the Center* F; *the leaſt the remainder of the ſame line* GB. *And of all the other lines, the line* GC *neareſt to that which was drawn through the center, is always greater than any line* DG *more remote*; *and only two lines are equal* GE, GH, *which fall upon the* ○ *from the ſame point, on each ſide of the leaſt* GB, *or of the greateſt* GA.

Pre. FRom the Center F draw FC, FD, FE; and [a] make the $\angle$ $BFH = BFE$.

Pro. 1. $GF + FC (= GA)$ [b] $\sqsubset GC$. *WWD.*

2. $FC =$ [c] FD and FG is common, alſo the $\angle GFC$ [d] $\sqsubset GFD$; [e] wherefore $GC \sqsubset GD$.

3. $FB = FE$ [f] $\sqsupset GE + GF$ and FG common. Therefore $FB - FG =$ [g] $GB \sqsupset GE$.

4. $FE = FH$, and FG is common, alſo the $\angle BFH$ [h] $= BFE$; therefore is [k] $GE = GH$. But that its impoſible for any other line GD from the point G, to equal GE or GH hath been already proved. *WWD.*

(a) 23. 1.
(b) 20. 1.
(c) 15 *def.* 1.
(d) 9 *ax.*
(e) 24. 1.
(f) 20. 1.
(g) 5 *ax.*
(h) *conſtr.*
(k) 4. 1.

Theorem 7.

Prop. VIII.

If some point A *be taken without a* $\bigcirc$, *and from that point be drawn certain Right-lines* AF, AG, AH *to the* $\bigcirc$, *and of those one* AH *be drawn through the center* L, *and the other any wise; of all these lines that fall on the concave of the circumference, that is the greatest* AH *which is drawn through the center; and of the others, that which is nearest to the line passing through the center, is greater than that which is remoter. But of all these lines that fall on the convex part of the* $\bigcirc$, *the least is that* AB *which is drawn from the point* A *to the Diameter* BH; *and of the others, that which is nearest to the least, is less than that which is farther distant, and from that point there can be only two equal Right-lines* AI, AE *drawn, which shall fall on the circumference on each side of the least line* AB, *or of the greatest* AH.

Pre. From the center L, draw the Right-lines LG, LF, LE, LC, LI and make the $\angle ALE = ALI$.

Pro. 1. $AH = AL + LG$ [a] $\sqsubset AG$.

2. $LG = LF$, and AL is common, also the $\angle ALG \sqsubset ALF$; [b] therefore $AG \sqsubset AF$.

3. LA [c] $\sqsupset LC + CA$, and $LB = LC$, if I take this latter from the there remains AB [d] $\sqsupset AC$.

4. $AC + CL$ [e] $\sqsupset AE + LE$, and $CL = EL$, [f] therefore $AC \sqsupset$ former AE.

5. $LI = LE$, and AL is common, also the $\angle ALE$ [g] $= ALI$; [h] therefore $AIL = AEL$. But that no other line could be drawn equal to these, was proved before. Therefore &c. *W W D.*

(a) 20. 1.
(b) 24. 1.
(c) 20. 1.
(d) 5 *ax.*
(e) 21. 1.
(f) 5 *ax.*
(g) *constr.*
(h) 4. 1.

Theorem 8.

Prop. IX.

If in a Circle BCD *a point be taken, and from that point more than two equal Right-lines* AB, AC, AD, *drawn to the circumference, then is that point* A, *the center of the* $\bigcirc$.

Pro. For [a] from no point without the centre can more than two equal Right-lines be drawn to the circumference. Therefore A is the centre. *W W D.*

(a) 7. 3.

Prop.

Prop. X.

Theorem 9.

A Circle, AEF *cannot cut another Circle* FDC *in more than two points.*

Pro. If it can let it in AEC, [a] From the center G draw GA, GC, GE, now because $GA = GC = GE$ touch the circumference of both Circles, the point G shall be [b] the center of both $\bigcirc^s$. [c] Which is absurd.

(a) 1. 3.
(b) 9. 3.
(c) 5. 3.

Prop. XI.

Theorem 10.

If 2 $\bigcirc^s$, ABC, AED, *touch one the other inwardly, in* A, *and their centers be taken* G, F; *a Right-line* FA *joyning their centres and produced, shall cut the Circumference in* A, *the point of contact of the Circles.*

Pro. If not, let the Right-line FG produced cut the Circles in some other point *viz.* D. And from the center G, of the $\bigcirc$ ABC let GA be drawn to the point of contact, as also FD. Now seeing $FD = FA$, and [a] $GD + GF \sqsubset FD$, its also $GD + GF \sqsubset$ [b] FA, and taking away the common part FG, the remainder GA [c] $\sqsubset GD$, But $GA =$ [b] GB, therefore $GB \sqsubset GD$, *viz.* the part than the whole. [d] Which is absurd.

(a) 20. 1.
(b) 15. *def.* 1.
(c) 7. 3.
(d) 9 *ax.* 1.

Prop. XII.

Theorem 11.

If 2 $\bigcirc^s$, ABC, EBD *touch one the other outwardly in* B, *the Right-line which joyns their centers shall pass through the point of contact.*

Pro. If not; let FG conjoyn their centres, and let FB, GB be drawn. Then $BF + BG$ [a] $\sqsubset FG$. But BF [b] $= FC$, and BG [b] $= GD$, therefore $FC + GD \sqsubset FC + CD + GD$, a part than the whole. Which is absurd.

(a) 20. 1.
(b) 15 *def.* 1.

Prop. XIII.

Theorem 12.

One $\bigcirc$ *cannot touch another* $\bigcirc$, *in more points than one, whether it be inwardly or outwardly.*

If it can, let them touch in both the points A and C. But then their centers must be in the [a] line conjoyning the points of contact, [b] yet not both the same or in the same point. Therefore there shall be two centers in that line, as G and H, which is impossible, seeing the line can be bisected but in one point only.

(a) 11 & 12 3.
(b) 6. 3.

I Prop.

Theorem 13.

Prop. XIV.

In a $\bigcirc$, A B C, *equal Right-lines* A B, D C *are equally distant from the center* E: *and Right-lines which are equally distant from the center, are equal among themselves.*

(a) 3. 3.
(b) 7 ax.
(c) 47 1 & 3 ax.
(d) 4 def. 3.
(e) 6 ax.

Pre. FRom the center E, draw $EF \perp AB$, and $EG \perp CD$, [a]which will bisect the lines AB, CD, also joyn EA, ED.

Pro. 1. $AB = DC$, therefore AF [b] $= DG$. But also $EA = ED$, therefore FEq [c] $= EAq - AFq$ [c] $= EDq - DGq = EGq$, therefore $FE = EG$. And consequently AB, CD [d] are equally distant from the center.

Pro. 2. $EF = EG$. Therefore AFq [c] $= EAq - EFq = EDq - EGq = DGq$. Therefore $AF = GD$ and [e] consequently $AB = DC$. *W W D.*

Theorem 14.

Prop. XV.

In a $\bigcirc$, A B C D, *the greatest line is* A F *the Diameter; and of all other lines, that line* B E *which is nearest to the center* G, *is greater than any remoter line* C D.

(a) 20. 1.
(b) 24. 1.

Pro. 1. DRaw GB, GE, then in the $\triangle GBE$, $GB + GE$ [a] $\sqsubset BE$. But $GB + GE = AF$, therefore $AF \sqsubset BE$. *W W D.*

Pro. 2. Draw GC, GD, then $GC + GD = GB + GE$, But the $\angle BGE \sqsubset \angle CGD$, [b] therefore the side $BE \sqsubset CD$. *W W D.*

Theorem 15.

Prop. XVI.

A line E F *drawn from the extream point of the Diameter* A C, *at* $\llcorner$*s to the said Diameter, shall fall without the* $\bigcirc$, A B C, *and between the same Right-line* E F *and the circumference, cannot be drawn another line* A B. *And the* $\angle$ *of the semicircle* D A G B, *shall be greater than any Right-lined acute* $\angle$; *and the remaining* $\angle$ *without the circumference,* E A G B *is less than any Right-lined* $\angle$.

(a) 19. 1.

Pro. 1. FRom the center D to any point F, in the Right-line FE draw the Right-line DHF. Then in the Right-angled $\triangle DEF$, DF [a] $\sqsubset (DA =) DH$, and seeing H is in the circumference, F must be without. *W W D.*

Pro.

(b) 19. 1.

Pro. 2. Draw $DK \perp AB$, then in the Right-angled $\triangle DKA$, $DA \sqsubset$ [b] DK, but the point A is in the circumference, therefore K, and consequently the whole line AB, shall be within the Circle. *W W D.*

Pro. 3. To constitute an $\angle$ greater than the $\angle DAGB$, there must be a Right-line drawn between the Right-line EA, and the periphery AB, which hath been proved already impossible; and therefore &c.

Pro. 4. So also to constitute a Right-lined $\angle$ less then the $\angle$ of contact $EAGB$, there must be drawn a Right-line between AE and the periphery AB, which hath been proved also impossible.

Corol.

A Right-line drawn from the extremity of the Diameter of a $\bigcirc$, and at $\llcorner$s, is a tangent to the said $\bigcirc$.

Problem 2.

Prop. XVII.

From a point given A, *to draw a Right-line* A C, *which shall touch a* $\bigcirc$ *given* B C D.

(a) 15 def. 1.
(b) 4. 1.
(c) 16. 3.

Pra. WIth the extent AD, from the center D, describe the Circle AE, and draw DA, also on B raise $BE \perp AD$. Then draw DE, and AC which will be a tangent to the $\bigcirc$ BCD.

Pro. For [a] $DB = DC$, and DE [a] $= DA$, and the $\angle D$ is common; [b] therefore the $\angle ACD = EBD = \llcorner$. [c] Therefore AC touches the $\bigcirc$ in C. *W W Dn.*

Theorem 16.

Prop. XVIII.

If any Right-line A B *touch a* $\bigcirc$ D C E, *and from the centre* D, *to the point of contact* C, *a Right-line* D C *be drawn: that line* D C *shall be a Perpendicular to the tangent* A B.

(a) 17. 1.
(b) 19. 1.
(c) 9 ax.

IF you deny it, let some other line DB be drawn from the centre D, Perpendicular to AB, then seeing the $\angle B$ is a $\llcorner$, shall be the $\angle C$ [a] $\sqsupset \llcorner$; therefore the side $DC = DE$ [b] $\sqsubset DB$. [c] Which is absurd.

Theorem 17.

Prop. XIX.

If a Right-line A B *touch a* $\bigcirc$, G C E, *and from the point of contact* C, *a Right-line* E C *be drawn at Right-angles to the tangent* A B, *the center of the* $\bigcirc$ *shall be in the said line* E C.

(a) 18. 3.
(b) 9 ax.

Pro. IF it be denied, let the center be somewhere else as in F; and from F to the point of contact, let FC be drawn. Then shall FC [a] $\perp AB$: and consequently $FCB = \llcorner = DCB$. [b] Which is absurd.

 Prop.

Theorem 18.

Prop. XX.

In a ○, DFGA, *the* $\angle$ BEC *at the center is double of the* $\angle$ BAC *at the circumference, when the same arch* BC *is the base of the* $\angle^s$.

Pro. This *Pro.* admits of a triple variety. 1. Draw the Diameter AEF, and let the Right-lines BA, AC include BE, EC; then $EA = EB$, [a] therefore the $\angle EBA = EAB$: but the $\angle BEF$ [b] $= EAB + EBA = 2BAF$, likewise the $\angle CEF = 2CAF$; therefore the whole $\angle BEC = 2BAC$. *WWD.*

(a) 5. 1.
(b) 32. 1.

2. But admit DG, DB which do not include the Right-lines EG, EB; then seeing $ED = EB$, the $\angle EDB =$ [c] EBD, and $GEB = EDB +$ [d] $EBD = 2GDB$. *WWD.*

(c) 5. 1.
(d) 32. 1.

3. Lastly, admitting the $\angle^s$ to intersect as BEC, BDC; now the $\angle GEC = 2GDC$. But the $\angle GEB = 2GDB$, therefore the remaining $\angle BEC = 2BDC$. *WWD.*

Theorem 19.

Prop. XXI.

In a ○, ADCB, *the* $\angle^s$ BAC, BDC *which are on the same segment, are equal one to the other.*

(a) 20. 3.
(b) 1 ax.

Pro. For the $\angle BEC$ [a] $= 2BAC = 2BDC$, [b] therefore the $\angle BAC = BDC$. *WWD.*

Theorem 20.

Prop. XXII.

The opposite $\angle^s$ DCB, DAB *of a quadrilateral figure* ABCD, *described in a* ○, *are equal to* 2 ∟^{s}.

(a) 21. 3.
(b) 32. 1.

Pro. Draw the Diagonals AC, DB: then the $\angle ADB$ [a] $= ACB$, also the $\angle BAC$ [a] $= BDC$, therefore the wh[illegible] $ADC = BCA + BAC$; but the $\angle^s$ $BCA + BAC + ABC$ [illegible] 2 ∟s: therefore the $\angle ADC (= BCA + BAC) + ABC = 2$ ∟[illegible] [illegible].

Corol.

A Circle cannot be described about a Rhomb[illegible] [illegible]posite $\angle$s are greater than 2 ∟s.

Prop.

Prop. XXIII.

Theorem 21.

Two like and unequal segments of a ○, DIF, DEF *cannot be set on the same Right-line* DF, *and the same side thereof.*

If they be like segments draw the lines ED, EF, and ID; then the $\angle DIF$ [a] $= DEF$. [b] Which is absurd.

(a) 10 def. 3.
(b) 16. 1.

Prop. XXIV.

Theorem 22.

Like segments of ○^{s} *upon equal Right-Lines* AB, DF *are equal one to the other.*

Pro. Let AB be placed on DF, [a] then they shall agree; if not the one must either wholly fall without or within the other, [b] which is absurd, or part without and part within; and so one ○ cut another in more than two points, [c] which is also absurd. [d] Therefore the segment $ACB = DEF$. *WWD.*

(a) 8 ax.
(b) 23. 3.
(c) 10. 3.
(d) 8 ax. 1.

Prop. XXV.

Problem 3.

A segment of a ○, ABD *being given, to describe the whole* ○, *whereof that is the segment.*

Pra. From any three points in the Arch, draw two Right-lines in the segment, as AB, BD which bisect with the ⊥^{s} CE, CF, which ⊥^{s} CE, CF shall cut one the other in C the center.

Pro. For the centre is in [a] both CE and CF, therefore it must be in the common point C. *WWD.*

(a) 1. 3.

Schol.

Hence three points being given, its easie to find the center of a Circle that shall pass through them.

Prop. XXVI.

Theorem 23.

In equal ○^{s} ABC, DEF, *equal* $\angle^s$ G *and* H, B *and* E *stand upon equal parts of the circumference* AC, DF; *whether those* $\angle^s$ *be made at the centers* G *and* H, *or at the circumferences* B, E.

Pro. Because the ○^{s} are equal, $GA = DH$, and $GC = HF$; and the $\angle G$ [a] $= H$; [b] therefore $AC = DF$. Also the $\angle B$ [c] $= \frac{1}{2} G$ $\frac{1}{2} H$ [d] $= E$: [e] therefore the segments ABC, DEF are like, and [f] consequently equal. [g] Whence also the remaining segment $AC = DF$. W[illegible]

(a) [illegible]
(b) [illegible]
(c) [illegible]
(d) [illegible]
(e) [illegible]
(f) [illegible]

Pro[illegible]

Theorem 24.

Prop. XXVII.

In equal ⊙s, ABI, DEF, *the* ∠s *standing upon equal parts of the circumference* AI, DF *are equal one to the other, whether they be constituted at the centers* G *and* H, *or at the circumference* B *and* E.

(a) 26. 3.
(b) *hyp.*
(c) 9 *ax.*

FOr if it be possible, let be one of the ∠s $AGC \sqsupset DHF$, and make $AGI = DHF$; then is the Arch AI [a] $= DF$ [b] $= AC$. [c] Which is absurd.

Theorem 25.

Prop. XXVIII.

In equal ⊙s ABC, DEF *equal Right-lines* AC, DF *cut off equal parts of the circumference, the greatest* ABC *equal to the greatest* DEF, *and the least, to the least.*

(a) 8. 1.
(b) 26. 3.
(c) 3 *ax.*

Pr. FRom the centers G and H draw GA, GC and HD, HF: then because the $\triangle AGC =$ [a] $\triangle DHF$; the $\angle G = \angle H$, and consequently the Arch $AC =$ [b] DF, and the remaining Arch ABC [c] $= DEF$. *WWD.*

Theorem 26.

Prop. XXIX.

In equal ⊙s ABC, DEF, *equal Right-lines* AC, DF *subtend equal peripheries,* ABC, DEF.

(a) *hyp.*
(b) 27. 3.
(c) 4. 1.

Pr. DRaw GA, GC, and HD, HF. Because $GA = HD$ and $GC = HF$, and (because the Arch $AC =$ [a] DF) the $\angle G$ [b] $= H$, [c] therefore is the base $AC = DF$. *WWD.*

This and the 3 preceeding *Prop.* may be understood also of the same ⊙.

Problem. 4.

Prop. XXX.

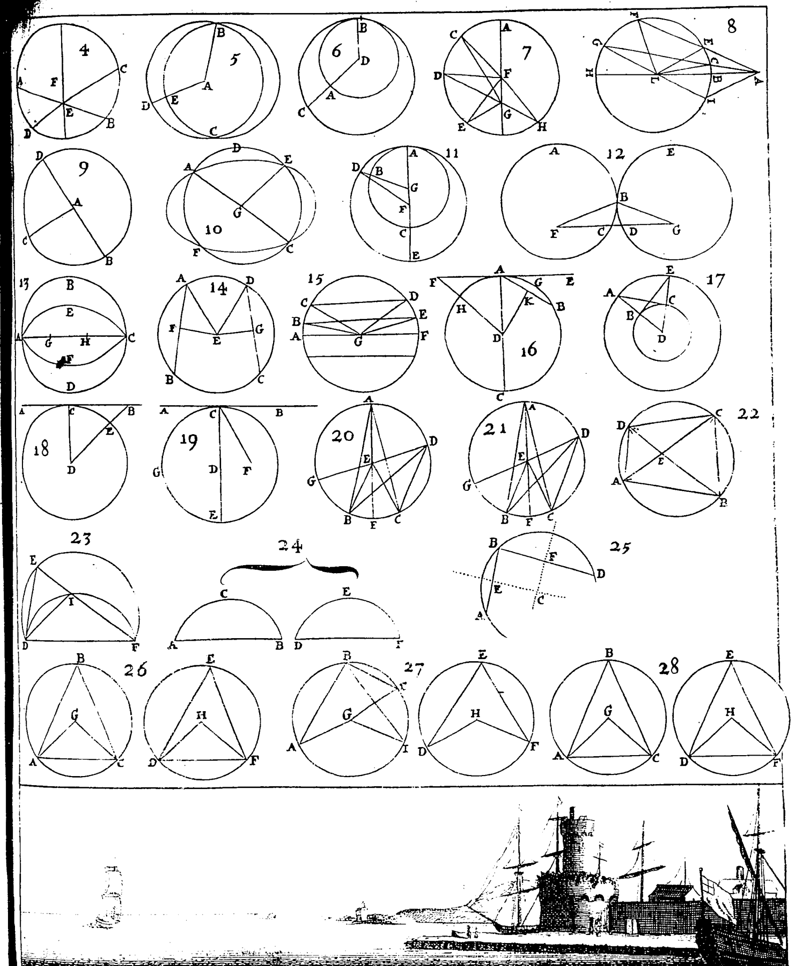
To cut a Periphery given ABC, *into two equal parts*

(a) 10. 1.
(b) *constr.*
(c) 10 *ax.*
(d) 4. 1.
(e) 28. 3.

Pr. DRaw the Right-line AC, and bisect it in [a] D, with the $\perp BD$ which shall bisect the Arch in B.

Pr. For AB, CB being drawn, the side DB is common, and $AD =$ [b] DC, and the $\angle ADB$ [c] $= CDB$. [d] Therefore $AB = BC$; [e] and the Arch $AB = BC$. *WWD.*

Prop.



Eucl. Page 68.

Prop. XXXI. Theorem 27.

In a $\odot$, ABEC *the* $\angle$ ABC *which is in the ſemicircle, is a Right* $\angle$; *but the* $\angle$ *which is the greater ſegment* BAC *is* $\sqsupset \llcorner$, *and the* $\angle$ *which is in the leſſer ſegment* BEC $\sqsubset \llcorner$: *Moreover the* $\angle$ CBA *of the greater ſegment is greater than a* $\llcorner$; *and the* $\angle$ EBC *of the leſſer ſegment is leſs than a* $\llcorner$.

Pro. 1. DRaw DA, DB, and DC; then the $\angle DAB =$ [a] DBA: (a) 5. 1.
alſo the $\angle DCB = DBC$, therefore the whole $\angle ABC$ (b) 32. 1.
$= \angle A + DCB =$ [b] $\angle FBC$ [c] $= \llcorner$, [d] and conſequently the $\angle ABC$ (c) 13. 1.
$= \llcorner$. (d) 1 ax.

Pro. 2. The $\angle ABC$ is $\llcorner$: therefore the $\angle$ in the greater ſegment *viz.* BAC [e] $\sqsupset \llcorner$. (e) 32. 1.

Pro. 3. Make the Quadrilateral $ABEC$, then the $\angle A$ [f] $\sqsupset \llcorner$, therefore the $\angle$ in the leſſer ſegment *ſci.* BEC [g] $\sqsubset \llcorner$. (f) 31. 3. (g) 22. 3.

Pro. 4. The $\angle$ contained under the Right-line CB, and Arch AB is $\sqsubset ABC$.

Pro. 5. But the $\angle$ made by the Right-line CB, and leſſer Arch EB, is leſs than the [h] $\llcorner FBC$. *WWD.* (h) 9 ax.

Schol. *Thales Mileſius.*

In any Right-lined Right-angled $\angle$, if the Hypothenuſe be biſected, that point ſhall be the center of a $\odot$, paſſing through the 3 angular points.

Prop. XXXII. Theorem 28.

If a Right-line AB *touch a Circle,* CHEG, *and from the point of contact* C, *be drawn a Right-line* CD, *or* EC, *cutting the* $\odot$, *the* $\angle$*s which it makes with the tangent line* AB, *are equal to thoſe* $\angle$*s which are made in the alternate ſegments of the* $\odot$, *That is the* $\angle$ ACE $= \angle$ G, *and the* $\angle$ BCE $= \angle$ H.

Pro. DRaw $DC \perp AB$, then the $\angle ACD = \llcorner$ [a] $= \angle DEC =$ [b] ECD (a) 31. 3.
$+ EDC$. But the $\angle BCE + ECD = \llcorner$: then taking away (b) 32. 1.
the common $\angle ECD$, the remaining $\angle BCE = EDC$ [c] $= CHE$, there- (c) 27. 3.
fore the $\angle BCE = CHE$. Again, ſeing in the Quadrilateral DG, the (d) 22. 3.
$\angle$s $EDC + EGC =$ [d] $2 \llcorner =$ [e] $ACE + ECB$, and the $\angle CDE =$ (e) 13. 1.
[f] BCE ſhall the remaining $\angle G = ACE$. *WWD.* (f) 32. 3.

Prop.

Problem 5.

Prop. XXXIII.

Upon a Right-line AB, *to describe a segment of a* ○, *which shall contain an* $\angle$ *equal to a Right-lined* $\angle$ *given* C.

(a) 23. 1. *Pra.*[a] MAke the $\angle BAD = C$. Through the point A draw $AE \perp DH$. At one end of the given line AB, make an $\angle ABF = BAF$, one side whereof may cut AE in F; with the extent AF, from the center F describe a ○, and it shall pass through [a] B, and AIB shall be the segment required.

(b) cor. 16 3. (c) 32. 3. (d) constr. *Pro.* For $HD \perp AE$, and so HD[b] touches the ○ which AB cuts, and therefore the $\angle AIB$[c] $= BAD$[d] $= C$. *WWDn.*

Problem 6.

Prop. XXXIV.

From a ○ *given* ABC, *to cut off a segment* CBA *containing an* $\angle$ B, *equal to a Right-lined* $\angle$ *given* D.

(a) 17. 3. (b) 23. 1. (c) 32. 3. (d) constr. *Pra.*[a] DRaw the tangent EF, touching the given ○ in A, [b] and make the $\angle CAE = D$, the segment ABC,[c] shall contain an $\angle B = CAE$[d] $= D$. *WWD.*

Theorem 29.

Prop. XXXV.

If in a ○, ADBC *two Right-lines* AB, CD *cut each other, the Rect-angle comprehended under the segments* AE, EB *of the one, shall be equal to the Rectangle under the segments of the other,* CE, ED. *That is* AE × EB = CE × ED.

Pro. 1. IF they cut one the other in the center, the thing is evident of it self.

(a) 3. 3. (b) 5. 2. (c) 47. 1. *Pro.* 2. If one line CD, pass through the center F, and bisect the other [a] AB, in E; draw FB. Now CD is cut equally in F, and unequally in E, therefore [b] $CE \times ED + EFq$ [a] $= FDq = FBq$ [b] $= FBq =$ [c] $FEq + EBq$. Therefore $\square\, CE \times ED + EFq = FEq + EBq$, take away EFq, it will leave $\square\, CE \times ED = EBq$. *WWD.*

(d) 5. 2. *Pro.* 3. Let CD pass by the Center F, but not dividing the Right-line AB, equally in E; draw FB and make $FG \perp$ to AB. Then the [d] $\square\, CE \times ED + EFq = FDq$ or FBq. Again $\square$ [d] $AE \times EB + GEq =$ [d] GBq. Add GFq. Now whereas $FBq = FGq + GBq$, the $\square\, AE \times EB + GEq + GFq = FBq$, that is, to the $\square\, CE \times ED$ and to the Square of FE. Therefore whereas $FEq = GFq + GEq$, if from one be taken FE and from the other EGq and GFq, there remains $\square\, CE \times ED = \square\, AE \times EB$. *WWD.*

Pro.

4. If neither of the lines pass by the Center, and yet cut the one the other, let GH be drawn through E by the Center F; Now whereas $\square\, CE \times ED =$ [c] $\square\, HE \times EG$, and that by the same Reason the $\square\, AE \times EB$ (e) $= GE \times HF$, therefore $\square\, CE \times ED = AE \times EB$. *WWD.* (e) p 3 pr. hereof.

Prop. XXXVI.

Theorem 30.

If there be taken some point A *without a Circle* FBE, *and from that point there fall two Right-lines to the Circle, one of which* AB *devides the Circle, and the other* AF *toucheth it; the Rectangle contained under the whole line dividing* AB *and its part* CA *without, taken between the Convex part* C *and point* A, *is equal to the square of the touching Line* AF.

Pro. 1. LEt the line AB pass by the Center D, drawing DF, the Right-line BC is bisected in D, and the part CA is added. The $\square$ (a) 6. 2.
$AB \times AC + DCq =$ [a] DAq. But $DAq =$ [b] $DFq + FAq$, and DFq (b) 47. 1. & 18. 3.
$= DCq$; take DCq away, rests $AB \times AC = FAq$.

Pro. 2. If the Right-line AE pass not by the Center D, draw $DG \perp$ (c) 3. 3. (d) 6. 2.
to AE, it will cut IE into halfs in [c] G; therefore $AE \times AI + GIq =$ [d] GAq, and adding DGq, then $AE \times AI + GIq + DGq = DAq + DGq$, but $GIq + DGq = DIq = DFq$; therefore $AE \times AI + DFq = GAq + DGq = DAq = DFq + FAq$, and taking away DFq from both sides it leaves $AE \times AI = FAq$. *WWD.*

Corol. 1. Hence it followeth, that if from any point without a Circle, there be drawn many lines to cut the Circle, the $\square$s comprehended under every of those lines and the parts without the Circle, are equal to one another.

Corol. 2. Two Right-lines, drawn from the same point without and touching the Circle, are equal.

Corol. 3. And from the same point there can be drawn but two lines to touch the Circle.

Prop. XXXVII.

Theorem 31.

If without the Circle FHE *any point* A *be taken, and from the same two lines* AF *and* AB *fall, so that one* AB *cut it and another* AF *fall upon it, so that the* $\square$ AB × AC = AFq; *the line* AF *shall touch the Circle.*

Pro.[a] DRaw the Tangent AH, and from H the Right-line DH, Now (a) 17. 3.
whereas $AHq =$ [b] $AB \times AC = FAq$, the lines AH and AF (b) 36. 3.
shall be equal, and $FD = DH$, and the base AD common, therefore the [c] $\angle$ (c) 8. 1.
$DFA = \angle DHA$, and because $\angle AHD$ [d] $= \angle AFD =$ [d] ∟, therefore AF shall touch the Circle per. *Corol.* 16. 3. *WWD.* (d) 18. 3.

The most noted Prop. of this Book are the 20, 22, 31, 35, and 36.

K THE

THE FOURTH BOOK OF Euclid's Elements.

DEFINITIONS.

1. A Right-lined figure is ſaid to be inſcribed in a Right-lined figure, when every one of the ∠ˢ of the inſcribed figure, touch every one of the ſides of the figure wherein it is inſcribed.

So the △ ABC, *is inſcribed in the* △ DEF: *becauſe the* ∠ˢ A, B, C *touch the ſides* DE, EF, DF.

2. In like manner a figure is ſaid to be deſcribed about a figure, when every one of the ſides of the figure circumſcribed touch every one of the ∠ˢ of the figure about which it is circumſcribed.

So the △ DEF, *is properly ſaid to be deſcribed about the* △ ABC.

3. A Right-lined figure is ſaid to be inſcribed in a ○, when all the ∠ˢ of that figure which is inſcribed do touch the circumference of the ○.

4. A Right-lined figure is ſaid to be deſcribed about a ○, when all the ſides of the figure which is circumſcribed, touch the periphery of the ○.

5. Likewiſe a ○ is ſaid to be inſcribed in a Right-lined figure, when the periphery of the ○ touches all the ſides of the figure in which it is inſcribed.

6. A Circle is ſaid to be deſcribed about a figure, when the periphery of the ○ touches all the ∠ˢ of the figure which it circumſcribes.

7. A Right-line is ſaid to be coapted or applied in a ○, when the extremes thereof fall upon the circumference.

So AB, *is rightly ſaid to be apply'd in the* ○, *and not* CD.

Prop. I.

Problem 1.

In a ○ *given* ABC, *to apply a Right-line* AB, *equal to a Right-line given* D, *which doth not exceed the* ○ˢ *diameter* BC.

Pra. WIth the extent $BE = D$, [a] from the center B deſcribe a ○ cutting the given ○ in A. Draw BA, then is BA [b] $= BE$ [c] $= D$. *WWDn.*

(a) 3 poſt. & 3. 1. (b) 15 def. 1. (c) conſtr.

Prop. II.

Problem 2.

In a ○ *given* ABC, *to deſcribe a* △ ABC, *equiangular to a* △ *given* DEF.

Pra. [a] DRaw the tangent GH, touching the ○ given in A, and make [b] the $\angle HAC = \angle E$, and $GAB = F$, alſo joyn BC, and the thing required is done.

Pro. For the $\angle B$ [c] $= HAC$ [d] $= E$, and the $\angle C$ [c] $= GAB$ [d] $= F$; [e] Whence alſo the $\angle BAC = D$. Therefore the △ ABC inſcribed in the ○, is equiangular to DEF. *WWDn.*

(a) 17. 3. (b) 23. 1. (c) 32. 3. (d) conſtr. (e) 32. 1.

Prop. III.

Problem 3.

About a ○ *given* BCE, *to deſcribe a* △ LM⊕ *equiangular to a* △ *given* DFA.

Pra. PRoduce the ſide AF of the given △ to G and H; and at the center I, [a] make an $\angle CIB = \angle DFH$, and $EIB = DAG$. Then to the points E, B, C, [b] let 3 touch lines be drawn as M⊕, ML, L⊕, and the thing is done: That the Right-lines M⊕, ML, L⊕ will meet and make a △ is evident, [c] becauſe (the ∠ˢ LEI, LBI being right; the [d] Right-line BE being drawn,) the ∠ˢ LEB, LBE will be leſs than 2 ∟s.

And ſeeing the $\angle EIB + L$ [e] $= 2$ ∟s [f] $= DAG + DAF$, and EIB [g] $= DAG$; [h] therefore the $\angle L = DAF$. By like reaſon the $\angle M = DFA$, [k] therefore alſo the ∠⊕ $= D$. And therefore the △ LM⊕ deſcribed about the ○ is equiangular to AFD, the given △. *WWDn.*

(a) 23. 1. (b) 17. 3. (c) 13 ax. (d) 11. 4. (e) 32. 1. (f) 13. 1. (g) conſtr. (h) 3 ax. (k) 32. 1.

Problem 4.

Prop. IV.

In a △ given ABC, *to describe a* ○, EFG.

(a) 9. 1.
(b) 12. 1.
(c) *constr.*
(d) 10 *ax.*
(e) 26. 1.

Pra.[a] BIsect the ∠s *B* and *C*, with the Right-lines *BD*, *CD*, meeting in the point *D*,[b] and draw the Perpendiculars *DE*, *DF*, *DG*. A ○ described with the extent *DG* from the center *D*, will pass through *F* and *E* also, and touch the 3 sides of the △.

Pro. For the ∠ *DBE*[c] = *DBF*; and the ∠ *DEB*[d] = *DFB*; and the side *DB* common, [e] therefore *DE* = *DF*, and for the same reasons *DG* = *DF*. Therefore the ○ passeth through the 3 points *E*, *F*, *G*. And because the ∠s *E*, *F*, *G*, are right, it also touches all the sides of the △. *WWDn.*

Schol.

Hence, the sides of a △ being known, their segments which are made by the points of contact of the inscribed ○ may be found; thus. Let *AB* be 12, *BC* 16, *AC* 18. Then shall *AB* + *BC* = 28. From which subtract *AC* 18, = *AE* + *FC*, and there shall remain 10 = *BE* + *BF*. And therefore *BE* or *BF* = 5; and consequently *FC* or *CG* = 11, *GA*, or *AE* = 7.

Problem 5.

Prop. V.

About a △ given ABC, *to describe a Circle.*

(a) 10 & 11 1.
(b) *constr.*
(c) 4. 1.

Pra.[a] BIsect any two sides *AB*, *BC*, with Perpendiculars *ED*, *FD*, meeting in the point *D*, this point *D* shall be the center of the ○, from which with the extent *BD*, the circle may be described circumscribing the △ given.

Pro. Draw the Right-lines *DB*, *DA*, *DC*. Then because *BE* =[b] *EA*, and *DE* is common and the ∠s at *E* right, shall *AD*[c] = *DB*. After the same manner is proved *DB*[c] = *DC*, therefore &c. *WWDn.*

Corol.

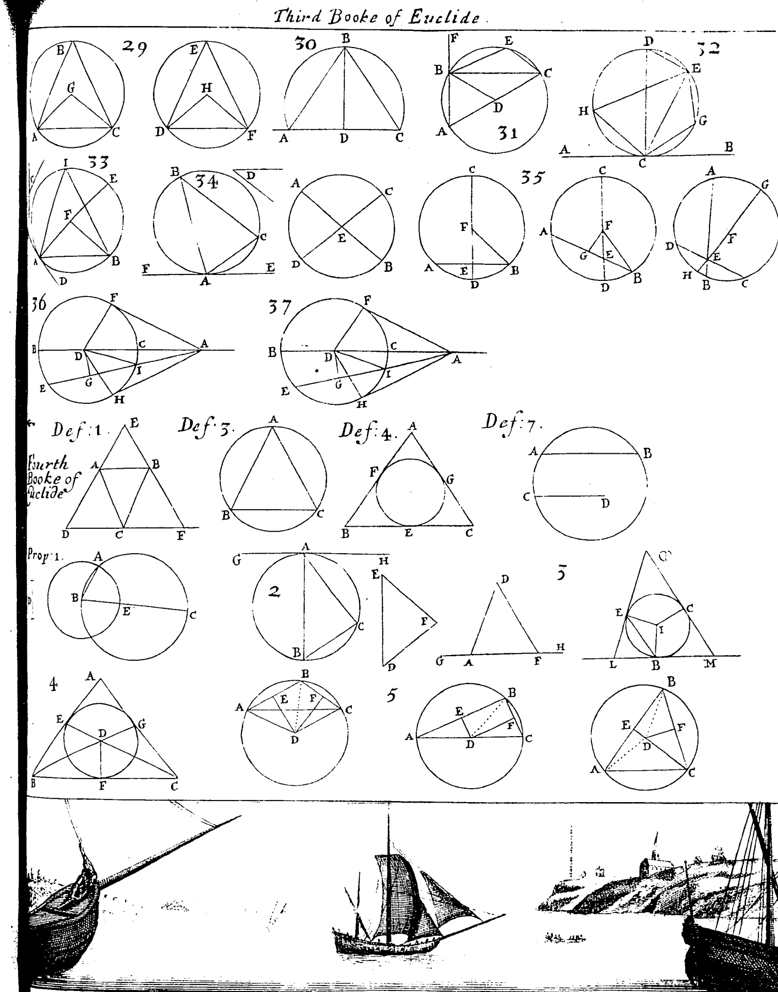
(d) 31. 3.

[d] Hence, if a △ be acute angled, the center shall fall within the △; if Right-angled, in the side opposite to the right ∠, and if obtuse angled, without the △.

Schol.

By this method also may a ○ be described, that shall pass through 3 points given, not lying in a strait line.

Prop.



Eucl: Page 7

Prop. VI. Problem 6.

In a given Circle ABC, *to inſcribe a Square.*

Pra.[a] DRaw the Diameters *AC*, *BD*, cutting each other at Right-angles (a) 11. 1.
in the center *E*, then drawing alſo the Right-lines *AB*, *BC*,
CD, *DA*. The thing required is done.
Pro. Becauſe the 4 ∠s at the center *E* are right, [a] the Arches and [b] ſub- (a) 26. 3.
tences *AB*, *BC*, *CD*, *DA* are equal; therefore is the figure *ABCD* (b) 29. 3.
equilateral, and all the ∠s in ſemicircles, and ſo [c] right. Therefore *AB* (c) 31. 3.
CD ſhall be a Square inſcribed in a ○. *WWDn.*

Prop. VII. Problem 7.

About a ○ given, to deſcribe a Square.

Pra.[a] DRaw the Diameters *AC*, *BD*, cutting one the other at right ∠s (a) 11. 1.
in the center *E*; then through the extremes of theſe Diameters,
[g] draw the ⊥s or tangents *FG*, *FI*, *IH*, *GH*, theſe produced till they (g) 17. 3.
meet in the points, *F*, *G*, *H*, *I*, ſhall conſtitute the required □.
Pro. Becauſe [b] the 4 ∠s at *E* are ∟s, as alſo thoſe at *A*, *B*, *C*, *D*, (b) 18. 3.
[c] therefore the Right-lines *FG*, *BD*, *HI*, are parallel, and alſo *FI*, *AC* (c) 28. 1.
GH, are parallel, [d] and therefore *FGIH* is a Right-angled parallelogram. (d) 34. 1.
And becauſe *FG* [d] = *HI* [d] = *DB* [c] = *CA* [d] = *GH* [d] = *FI*. it's alſo (e) 15 *def.* 1.
equilateral, and conſequently a [f] Square. *WWDn.* (f) 29 *def.* 1.

Schol.

The Square circumſcribing a ○, is double the Square inſcribed in the
ſame ○. For *BA*, *AD* (the ſides of an inſcribed □) being drawn, the [g] □ (g) 41. 1.
$BG = 2\,BAD$, and $BH = 2\,BCD$.

Prop. VIII. Problem 8.

In a Square given, to deſcribe a Circle.

Pra.[a] BIſect the ſides of the given Square in *A*, *B*, *C*, *D*, and draw *AC*, (a) 10. 1.
BD, cutting one the other in *E*, from which as center with the
extent *EB* if a ○ be deſcribed, the Problem is anſwer'd.
Pro. Becauſe *AF*, *IC*, are parallel and equal, *FG*, *HI*, as alſo *AC*, *FI* (b) 33. 1.
[b] are parallel and equal, and likewiſe *AC*, *HG*, [c] therefore *FE*, *EI*, *EH*, (c) *def.* 35. 1.
EG are ▭s. And becauſe *BF* [d] = *FA* = [c] *AE* = *EB* = *EC* = *ED*, (d) 7 *ax.* 1.
[e] therefore ſhall *E* be the center, from which with the extent *EA* a ○ being (e) 34. 1.
deſcribed, ſhall touch all the points *ABCD*, and conſequently all the ſides
of the Square. *WWDn.*

Prop.

Problem 9.

Prop. IX.

About a given Square, to describe a Circle.

Pra. DRaw the diameters *AC*, *BD*, cutting one the other in *E*. From the center *E*, through *A* describe a ○, which shall answer the Problem.

(a) 4 *cor.* 32. 1. *Pro.* For the ∠ *ABD* = *BAC* = [a] ½ ∟, [b] therefore *AE* = *EB*.
(b) 6. 1. After the same manner is *AE* = *ED* = *EC*. The ○ therefore described from the center *E* passes through *A*, *B*, *C*, *D*, the ∠s of the □ given. *W W D n.*

Problem 10.

Prop. X.

To make an Isosceles △ ABD, *having each* ∠ *at the base* B *and* D, *double to the remaining* ∠ A.

(a) 11. 2. *Pra.* TAke any Right-line *AB*, and divide it [a] so in *C*, that *AB* × *BC*
= *ACq*. Then from the center *A*, through *B*, describe a ○, in which
(b) 1. 4. let be [b] applied *BD* = *AC*, and joyn *AD*. I say *ABD* is the △ required:
(c) 5. 4. Which is thus proved.
(d) 37. 3. *Pro.* Draw *DC*, and through the points *ADC* [c] describe a ○. Now
(e) 32. 3. seeing *AB* × *BC* = *CAq* = *BDq*, [d] it's evident, that *BD* touches the circle
(f) 2 *ax.* *ACD* which *DC* cutteth; [e] therefore is the ∠ *BDC* = *A*, and therefore
(g) 32. 1. also the ∠ *BDC* + *CDA* [f] = *A* + *CDA* [g] = *BCD*. But *BDC* +
(h) 5. 1. *CDA* = *BDA* [h] = *CBD*; [k] therefore the ∠ *BCD* = *CBD*, and there-
(k) 1 *ax.* fore *DC* [l] = *DB* = [m] *AC*, [n] seeing the ∠ *CDA* = *A* = *BDC*; there-
(l) 6. 1. fore *ADB* = 2 *A* = *ABD*. *W W D n.*
(m) *constr.*
(n) 5. 1.

Corol.

Seeing all the 3 ∠ *A*, *B*, *D*, together make 2 ∟s, it is evident that *A* is ⅖ of 2 ∟s.

Prop. XI.

In a ○ *given* EHFGI, *to describe a Pentagone Figure equilateral and equiangular.*

(a) 10. 4. *Pra.* [a] MAke an Isosceles △, having each ∠ at the base double to
(b) 2. 4. that at the vertex, [b] and inscribe one equiangular thereto
(c) 9. 1. in the ○ given *EFG*. [c] Bisect the ∠s at the base with the lines *IF*, *HG*, and lastly, joyn these 5 points *E*, *H*, *F*, *G*, *I*, with so many Right-lines, and the thing required is done.

Pro.

Pro. Seeing by the construction the ∠ *EFG*, *FGH*, *HGE*, *IFG*, *EFI*,
are equal; [d] the Arches and their [e] subtended lines *FG*, *FH*, *HE*, *EI*, *IG*, (d) 26. 3.
are equal. Then the Arch *EH* = *FG*. Therefore if *HF* be put common, (e) 29. 3.
the Arch *EHF* = *HFG*: and so the other segment *FG* = *IE* = *GI* =
EH: [f] therefore the ∠ *EHF* = *HFG*, and the same may be said of the (f) 27. 3.
rest. Therefore is the inscribed Pentagone both equilateral and equiangular. *W W D n.*

Corol.

Each ∠ of an equilateral and equiangular Pentagone, is equal to ⅗ of 2 ∟s, or ⁶⁄₅ of one ∟.

Prop. XII. Problem 12.

About a ○ *given* ABCD, *to describe an equilateral and equiangular Pentagone* GHIKL.

Pra. IN the ○ given [a] inscribe a Pentagone *CBAED*; and from the center (a) 11. 4.
F draw the Right-lines *FA*, *FB*, &c. and to those points *C*, *B*, *A*, *E*, *D*; draw so many touch lines, which meeting in the points *G*, *H*, *I*, *K*, *L*, shall compleat the Pentagone required.
Pro. Because *HA*, *HB*, from the same point *H* [b] touch the ○, [c] there- (b) *cor.* 16. 3.
fore is *HA* = *HB*, and [d] therefore the ∠ *AFH* = *HFB*, therefore the (c) 2 *cor.* 36. 3.
∠ *AFB* = 2 *HFA*. After the same manner is the ∠ *BFI* = *IFC*, (d) 8. 1.
and consequently the ∠ *BFC* = 2 *BFI*. [e] But the ∠ *AFB* = *CFB*, (e) 27. 3.
[f] therefore the ∠ *HFB* = *BFI*. But also the ∠ *FBI* [g] = *FBH*; and (f) 7. *ax.*
the side *FB* is common, [h] therefore *IB* = *BH* = *HA* = *AG*, &c. [k] There- (g) 10 *ax.*
fore the sides *IH* = *GH* = *GL* = *LK* = *KI*, the ∠s also are equal, (h) 26. 1.
because double of the equal ∠s *BHF*, *BIF*. Therefore the Pentagone (k) 2 *ax.*
is both equilateral and equiangular. *W W D n.*

Corol.

Hence, if any equilateral and equiangular figure be inscribed in a Circle, and at the extremes of the semidiameters be raised ⊥s to the said diameters, these ⊥s shall constitute another figure of as many equal sides, and equal ∠s circumscribed about the ○.

Prop.

Problem 13.

Prop. XIII.

In an equilateral and equiangular Pentagone given, to inscribe a Circle.

(a) 9. 1. (b) 11 ax.

Pra.[a] BIsect two ∠s BAE, ABC, with the Right-lines AF, BF, [b] meeting in the point F. From F draw the Perpendiculars FG, FH, FI &c. Then a ○ described from the center F, with the extent FG will touch all the sides of the Pentagone.

(c) constr. (d) 4. 1. (e) hyp. (f) 10. ax. (g) 26. 1. (h) cor. 16. 3.

Pro. Because, in the △s ABF, FBC, the side $BA = BC$, and BF is common, and the ∠ ABF[c] $= CBF$; Therefore is the ∠ BAF[d] $=$ BCF, and $AF = CF$. But the ∠ BAF[e] $= \frac{1}{2}\, BAE = BCF = \frac{1}{2}\, BCD$. Therefore the ∠ $FCB = \frac{1}{2}\, BCD$. After the same manner are all the other ∠s bisected. Because the ∠ FGB[f] $= FLB$, and the ∠ GBF $= FBL$, and the side FB common; [g] therefore is $FG = FL$. In like manner are all the lines FK, FI, FH, equal. Therefore a ○ described from the center F, with the extent FG, passes through the points H, I, K, L, and touches the [h] sides of the Pentagone, because the ∠s at those points are right. *W W D n.*

Corol.

Hence, if any two nearest ∠s of an equilateral and equiangular figure be bisected, and from the point in which those bisecting lines meet, be drawn Right-lines to the remaining ∠s of the figure, all the ∠s of the figure shall be bisected.

Schol.

By the same method shall a ○ be inscribed, in any equilateral and equiangular figure.

Problem 14.

Prop. XIV.

About a Pentagone given, which is both equilateral and equiangular to describe a Circle.

Pra. BIsect any two ∠s of the Pentagone, as A and E, with the Right-lines AF, FE, meeting in the point F; the ○ described from the center F, through A, shall be described about the Pentagone.

(a) 13. 4. (b) 6. 1.

Pro. Let FD, FC, FB, be drawn. [a] Then the ∠s D, C, B, are bisected; [b] and therefore $FA = FB = FC = FD = FE$. Therefore the ○ described from the center F, &c. shall circumscribe the Pentagone. *W W D n.*

Schol.

By the same method shall a ○ be described, about any equilateral equiangular figure.

Prop.

Prop. XV.

Problem 15.

In a given Circle to inscribe an Hexagone (or six sided figure) equilateral and equiangular.

(a) 15 def. 1. (b) 8. 1. (c) cor. 32. 1. (d) 15. 1. (e) 13. 1. (f) 26. 3. (g) 29. 3. (h) 27. 3.

Pra. DRaw the diameter AD; from D with the extent DG describe a ○ cutting the ○ given in the points C and E. Draw the diameters CF, EB, and joyn AB, BC, CD, DE, EF, FA, and it's done.

Pro. The Right-lines GC[a] $= GD$[a] $= CD = DE$; therefore the △ DGC is equilateral, and [b] consequently equiangular. Then the ∠ CGD [c] $= \frac{1}{3}$ of 2 ∟s $= DGE$[d] $= AGF$[d] $= AGB$. And seeing $CGE + EGF$ [e] $=$ 2 ∟s shall $EGF = \frac{1}{3}$ of 2 ∟s. Therefore the [f] arches and [g] subtenses AB, BC &c. are equal, therefore the Hexagon is equilateral; and also equiangled [h] seeing the ∠s of it stand upon equal arches.

Corol.

1. The side of an Hexagon inscribed in a ○ is equal to the semidiameter.

Schol.

1. Hereby an equilateral △ may easily be described in a Circle *viz.* by drawing AC, AE, CE.

2. To make a true Hexagon upon a Right-line given CD. [a] Make an equilateral △ CGD, upon the given line CD, describing a ○ with the extent CG from the center G. That ○ shall contain the Hexagone required. *Andr. Tacq.* (a) 1. 1.

Prop. XVI.

Problem 16.

In a given Circle to inscribe a Quindecagon (or fifteen sided figure) equilateral and equiangular.

(a) 11. 4. (b) 2. 4. (c) constr. (d) 27. 3.

Pra.[a] INscribe in the given ○ an equilateral Pentagon $AEFGH$, and [b] also an equilateral △ ABC, then is BF the side of the Quindecagon required.

Pro. For the arch AB[c] is $\frac{1}{3}$ or $\frac{5}{15}$ of that periphery, whereof AF is $\frac{2}{5}$ or $\frac{6}{15}$. Therefore the remaining part BF is $\frac{1}{15}$ of the periphery; and therefore the Quindecagon, whose side is BF, is equilateral, but it is equiangular also, [d] because all the ∠s insist on equal arches, whereof every one is $\frac{1}{15}$ of the whole circumference, Therefore &c.

Schol.

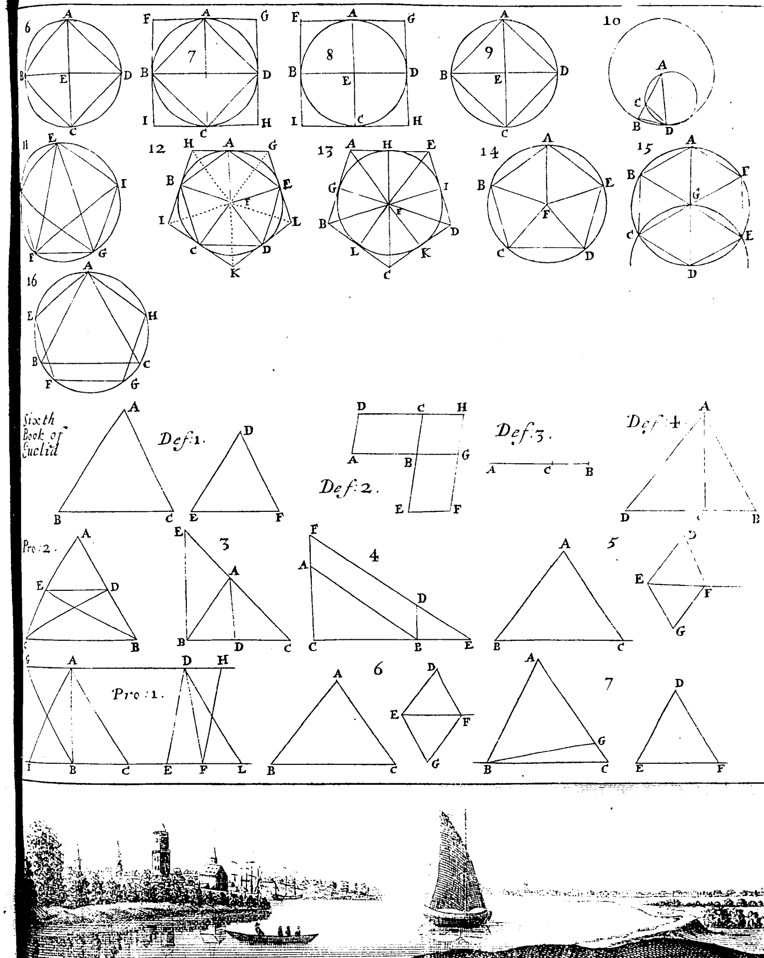
Schol.

A Circle is Gemoetrically divided into parts.	
	4, 8, 16, &c. by 6, 4, and 9, 1.
	3, 6, 12, &c. by 15, 4, and 9, 1.
	5, 10, 20, &c. by 11, 4, and 9, 1.
	15, 30, 60, &c. by 16, 4, and 9, 1.

To divide the circumference into any other parts, is yet unknown; wherefore in the construction of ordinate figures, we are forced to have recourse to mechanick artifices.

THE

4th. Book .



Eucl: Page 80

THE

FIFTH BOOK OF Euclid's Elements.

DEFINITIONS.

1. A *Part*, is a Magnitude of a Magnitude, a less of a greater, when the less measureth the greater.

2. *Multiplex* is a greater, when the lesser measureth the greater.

3. *Ratio*, (or Rate) is the mutual habitude of two Magnitudes of the same kind each to other, according to quantity.

In every Ratio, that quantity which is referred to another quantity, is called the antecedent of the Ratio; and that to which the other is referred is called the consequent of the Ratio, as in the Ratio 6 to 3, 6 is the antecedent and 3 the consequent.

Note, The quantity of any Ratio, is known by dividing the antecedent by the consequent; as the Ratio of 12 to 5, is expressed by $\frac{12}{5}$; or the quantity of the Ratio, of a to b, is $\frac{a}{b}$. Wherefore often for brevity sake we

denote the quantities of Rations thus; $\frac{a}{b} \sqsubset$, or $=$, or $\sqsupset \frac{c}{d}$, that is, the Ratio of a to b, is greater, equal, or less, than the Ratio of c to d.

4. *Proportion* is a Similitude of Ratio's.

That which is here termed proportion, is more rightly called proportionality or Analogy; for proportion commonly denotes no more than the Ratio between two Magnitudes.

5. Those numbers are said to have a Ratio betwixt them, which being multiplied may exceed one the other.

g, 12	a, 3. b, 6	k, 30.
h, 20	c, 5. d, 10	l, 50.

6. *Magnitudes*, are said to be in the same Ratio, the first a to the second b, and the third c to the fourth d, when the equimultiplices g and h, of the first a, and the third c compared with the equimultiplices k, l, of the second b, and the fourth d; according to any multiplication whatsover, either both together g, h, are less than k, l, both together, or equal taken together; or exceeding one the other together if those be taken g, k, and h, l, which answer one to the other. That is, compare the multiplex of the first, with the multiplex of the second, and the multiplex of the third with that of the fourth; and see, whether as often as the multiplex of the first contains or is contained by the multiplex of the second, so often the multiplex of the third contains or is contained by the multiplex of the fourth; for if it be so, then are those 4 quantities in the same Ratio, otherwise not. Thus, seeing k 30 contains g 12, as often as l 50 contains h 20, *viz.* $2\frac{1}{2}$, a, b, and c, d, or 3, 6, and 5, 10, are in the same Ratio. The note of identity of Ratio is $::$, as in the former example, $a \,.\, b :: c \,.\, d$, but sometimes it's expressed $\frac{a}{b} = \frac{c}{d}$.

g, 30	a, 6. b, 4	k, 28.
h, 60	c, 12. d, 9	l, 63.

7. Magnitudes that have the same Ratio, are called *Proportionals*.

8. When of equimultiplices, g, the multiplex of the first a, exceeds k the multiplex of the second b, but h, the multiplex of the third c, exceed not l, the multiplex of the fourth d, then the first a, to the second b, has a greater Ratio; then the third c, to the fourth d.

If $\frac{a}{b} \sqsupset \frac{c}{d}$, it is not necessary from this definition that g, should always exceed k; when h is less than l, but it is granted that this may be.

9. *Proportionality* consists in three terms at least. Whereof the second supplies the place of two.

10. When three Magnitudes a, b, c, are proportional, the first a, shall have a *duplicate Ratio*, to the third c, of that it hath to the second b: But when 4 Magnitudes a, b, c, d, are proportional, the first a, shall have a *triplicate Ratio*, to the fourth d, of what it had to the second b; and so always one more in order, as the proportion shall be extended.

Duplicate

Duplicate Ratio is thus expressed, $\frac{a}{c} = \frac{a^2}{d}$. And triplicate Ratio thus; $\frac{a}{c} = \frac{a^3}{d}$. That is the Ratio of a to c, is triple of the Ratio of a to d.

11. Magnitudes of a like Ratio, are antecedents to antecedents; and consequents to consequents; as if $a \,.\, b :: c \,.\, d$. a and c, and b and d, are homologous or Magnitudes of a like Ratio.

In the 6 following Definitions, names are given to the 6 ways of arguing, used by Mathematicians, which will be demonstrated in their places in this Book.

12. *Alternate Proportion* is the comparing of antecedent to antecedent, and consequent to consequent. As if $a \,.\, b :: c \,.\, d$, then alternately it's $a \,.\, c :: b \,.\, d$. By 16, 5.

13. *Inverse Ratio*, is when the consequent is taken as the antecedent, and so compared to the antecedent as the consequent; as $a \,.\, b :: c \,.\, d$. Therefore generally $b \,.\, a :: d \,.\, c$, by *Cor.* 4, 5.

14. *Compound Ratio*, is when the antecedent and consequent taken both as one, are compared to the consequent it self; as $a \,.\, b :: c \,.\, d$. Therefore by composition $a+b \,.\, b :: c+d \,.\, d$, by 18, 5.

15. *Divided Ratio*, is when the excess wherein the antecedent exceedeth the consequent, is compared to the consenqent. As $a \,.\, b :: c \,.\, d$. Therefore by Division $a-b \,.\, b :: c-d \,.\, d$, by 17, 5.

16. *Converse Ratio*, is when the antecedent is compared to the excess, wherein the antecedent exceeds the consequent. As $a \,.\, b :: c \,.\, d$. Therefore by converse Ratio, $a \,.\, a-b :: c \,.\, c-d$, by *Cor.* 19, 5.

17. *Proportion of equality* is where there are taken more Magnitudes than two in one order, and also as many Magnitudes in another order, comparing two to two being in the same Ratio; it cometh to pass that as in the first order of Magnitudes, the first is to the last, so in the second order of Magnitudes is the first to the last. Or thus; it is a comparison of the extremes together, the means being omitted.

18. *Ordinate Proportionality* is, when, as the antecedent is to the consequent, so is the antecedent to the consequent, and as the consequent is to any other, so is the consequent to any other. As $a \,.\, b :: d \,.\, e$, also $b \,.\, c :: e \,.\, f$, it shall be also $a \,.\, c :: d \,.\, f$, by 22, 5.

19. *Inordinate Proportion* is, when 3 Magnitudes being put, and others also, which are equal to these in Multitude, as in the first Magnitudes the antecedent is to the consequent; so in the second Magnitudes is the antecedent to the consequent: and as in the first Magnitudes the consequent is to any other, so in the second Magnitudes any other thing to the antecedent. As $a \,.\, b :: f \,.\, g$, also $b \,.\, c :: e \,.\, f$, it shall be true in ordinate proportion, $a \,.\, c :: e \,.\, g$, by 23, 5.

20. Any number of Magnitudes being put; the proportion of the first to the last, is compounded of the proportions of the first to the second, the second to the third, and the third to the fourth &c. till the proportion arise.

Axioms.

Axiome.

Magnitudes equimultiplices to the ſame multiplex, are alſo equimultiplices betwixt themſelves.

Theorem 1.

Prop. I.

3 1 3 1
a. e. c. f.
6 2
g. h.

If there be a number of Magnitudes howmany ſoever a, c, *equimultiplices to a like number of Magnitudes* e, f, *each to other ; how multiplex one Magnitude* a, *is to one* e, *ſo multiplices are all the Magnitudes* a + c *to all the other Magditudes* e + f. *That is, becauſe* a *to* e, *and* c *to* f, *are* [a] *equimultiplices. If* a *and* c *be joyned in* g, *and likewiſe* e *and* f *in* h, *how multiplex* a *ſhall be of* e, *and* c *of* f. *So multiplex ſhall* g *be of* h.

(a) 25 def.

Pro. Becauſe as well *g*, as *h*, are augmented by an equal number of containing and contained parts.

Theorem 2.

Prop. II.

6 3 4 2
a. b. c. d.
9 6 15 10
e. f. g. h.

If the firſt a *be equimultiplex to the ſecond* b, *as the third* c *is to the fourth* d; *and if the fifth* e *be equimultiplex to the ſecond* b, *as the ſixth* f *is to the fourth* d; *then ſhall the firſt compounded with the fifth* (g) *be equimultiplex to the ſecond* c, *as the third compounded with the ſixth* (h) *is to the fourth* d.

(a) hyp.
(b) 1. 5.

Pro. [a] The ſecond *b* and fourth *d*, are contained alike numbers of times in their multiplices *a* and *c*, *viz.* twice, and likewiſe the ſame ſecond *b* and fourth *d*, are contained alike numbers of times in their other multiplices *e* and *f*, *viz.* thrice. [b] Therefore they ſhall alſo be contained alike number of times in the compound multiplices, that is, if it be made that *a* + *e* = *g*, and likewiſe *f* + *c* = *h*; then as *g* contains *b* five times, ſo ſhall *h* contain *d* five times.

Prop.

Theorem 3.

Prop. III.

4 2 6 3
a. b. c. d.
8 12
e. f.

If the firſt a *be equimultiplex to the ſecond* b, *and the third* c *of the fourth* d, *and there be taken* e *and* f *equimultiplices of the firſt and third, then will each of the Magnitudes taken be alike equimultiplex of both, the one* e *to the ſecond* b, *the other* f *to the fourth* d.

(a) 1. 5.

Pro. Let *b* and *d*, be contained alike number of times in each of theſe *a* and *c*; [a] then they ſhall alſo be contained an equal number of times in any the multiplices of *a* and *c* as *e* and *f*.

Theorem 4.

Prop. IV.

4 2 6 3
a. b. c. d.
8 6 12 9
e. f. g. h.
16 12 24 18
l. m. k. n.

If the firſt a, *have the ſame Ratio to the ſecond* b, *as the third* c *to the fourth* d; *then alſo* e *and* g, *the equimultipliees of the firſt* a *and the third* c, *ſhall have the ſame Ratio to* f *and* h; *the equimultiplices of the ſecond* b *and the fourth* d, *according to any Multiplication, if ſo taken as they anſwer each one the other.*

(a) 3. 5.
(b) hyp.

Take *l* and *k* the equimultiplices of *e* and *g*; and alſo *m* and *n* the equimultiplices of *f* and *h*. [a] Then is *l* as multiplex of *a*, as *k* of *c*; [a] and alſo *m* is as multiplex of *b*, as *n* of *d*. Therefore whereas it is *a* . *b* [b] :: *c* . *d*; according to the ſixth definition, if *l* be ⊏, =, ⊐ *m*, then conſequently, after the ſame manner is *k* ⊏, =, ⊐ *n*. Therefore when *l* and *k* are taken as multiplices of *e* and *g*, as *m* and *n* of *f* and *h*, then will it be by the 7 *def.* *e* . *f* :: *g* . *h*. *WWD.*

Corol.

(c) 2 def. 5.
(d) 6 def. 5.

From hence is wont to be demonſtrated the proof of inverſe (or converſe) Ratio.

For becauſe *a* . *b* :: *c* . *d*, therefore if *e* ⊏, =, ⊐ *f*, then is [c] likewiſe *g* ⊏, =, ⊐ *h*; therefore it's evident that if *f* ⊏, =, ⊐ *e*, then is *h* ⊏, =, ⊐ *g*; [d] therefore *b* . *a* :: *d* . *c*. *WWD.*

Prop.

Theorem 5.

Prop. V.

e, 4. f, 2.
c, 8. d, 4.
a, 12. b, 6.
g, 4.

If a Magnitude a, *be as multiplex of a Magnitude* b, *as part taken from the one* c, *of a part taken from the other* d; *the reſidue of the one* e, *ſhall be as multiplex of the reſidue of the other* f, *as the whole* a *is of the whole* b.

(a) 1. 5.
(b) 6 ax. 1.
(c) 3 ax. 1.

TAke any other g, which ſhall be as multiplex to f, as a is of b, or as the part taken away c is of the part d. (a) Therefore $g+c$ is as multiplex of $d+f$; as the one c of the one d, that is, as a of b. Therefore $g+c$ (b) $= a$; and (c) ſo c that was common being taken away, there remains $g = e$.

Theorem 6.

Prop. VI.

g 2, h 3,	g 8, h 12,
e 10, f 15,	e 4, f 6,
a 12, b 18,	a 12, b 18,
c 2, d 3,	c 2, d 3,

If two Magnitudes a *and* b, *be equimultiplices of two Magnitudes* c, d; *and ſome Magnitudes* e, f, *equimultiplices of the ſame* c, d, *be taken away; then the reſidues* g, h, *are either equal to theſe Magnitudes* c, d *or elſe the equimultiplices of them.*

(a) Hyp.
(b) 5. 5.

Pr. C and d, are (a) contained an equal number of times in a and b, and alſo in ſome of their parts c, f: (b) therefore they ſhall alſo be contained an equal number of times in the reſidues g and h. Therefore the reſidues, are either equal or equimultiplices. *W W D.*

Theorem 7

Prop. VII.

24 8 24
d. f. c.
a. a.
12 b. 12
4

Equal Magnitudes a *and* a, *have to the ſame Magnitude* b, *the ſame proportion or Ratio. And one and the ſame Magnitude* b *hath the ſame Ratio, to equal Magnitudes* a *and* a.

(a) 6 ax. 1.
(b) 6 def. 5.
(c) cor. 4. 5.

Pr. TAke d and c, equimultiplices of the equal Magnitudes a and a, and f any wiſe multiplex of b; then is d (a) $= c$. Wherefore if $d \sqsubset, =, \sqsupset f$; then alſo c will be $\sqsubset, =, \sqsupset f$. (b) Therefore $a \,.\, b :: a \,.\, b$. and (c) by inverſion $b \,.\, a :: b \,.\, a$. *W W D.*

Schol.

Schol.

If inſtead of the multiplex f, two equi-multiplices be taken, it ſhall be the ſame way proved that equal Magnitudes have the ſame Ratio, to other Magnitudes that are equal between themſelves.

Prop. VIII.

Theorem 8.

16 8 5
a. b. c.
6 4 8
d. e. f.
32 16 20

Of unequal Magnitudes a, b, *the greater* a *hath a greater Ratio to the ſame third* c, *then the leſſer* b; *and the ſame third* c *hath a greater Ratio to the leſſer* b, *then to the greater* a.

Pr. TAke d and e, equimultiplices of the ſaid a, b, and alſo f a multiplex of c, greater than e but leſs than d, (which will eaſily happen, if both e and $d-e$ be taken greater than c.) It is manifeſt from 8 *def.* 5. That $\frac{a}{c} \sqsubset \frac{b}{c}$, and $\frac{c}{a} \sqsupset \frac{c}{b}$. *W W D.*

Prop. IX.

Theorem 9

a. b. c.
15 15 4

Magnitudes which to one and the ſame Magnitude have the ſame Ratio, are equal one to the other. And if a Magnitude have the ſame Ratio to other Magnitudes thoſe Magnitudes are equal one to the other.

Hyp. 1. IF $a \,.\, c :: b \,.\, c$, then $a = b$; For let a be $\sqsubset$, or $\sqsupset c$, (a) then is $\frac{a}{c} \sqsubset$ or $\sqsupset \frac{b}{c}$. Which is contrary to the *Hyp.* (a) 8. 5.

Hyp. 2. If $c \,.\, b :: c \,.\, a$; then $a = b$. For let a be $\sqsubset b$, (b) then $\frac{c}{b} \sqsubset \frac{c}{a}$. Which is againſt the *Hyp.* (b) 8. 5.

Prop. X.

Theorem 10.

16 8 4
a, b, c,

Of Magnitudes having Ratio to the ſame Magnitude, that which hath the greater Ratio, is the greater Magnitude; and that Magnitude to which the ſame bears a greater Ratio, is the leſſer Magnitude.

Hyp. 1. IF $\frac{a}{c} \sqsubset \frac{b}{c}$; then $a \sqsubset b$. For if $a = b$, (a) then $a \,.\, c :: b \,.\, c$. which (a) 7. 5. is contrary to the *Hyp.* If $a \sqsupset b$, (b) then is $\frac{a}{c} \sqsupset \frac{b}{c}$. Which is (b) 8. 5. alſo againſt the *Hyp.*

 Hyp. 2.

Hyp. 2. If $\frac{c}{b} \sqsubset \frac{c}{a}$; then $b \sqsupset a$. For if $b = a$, its againſt the *Hyp.* for it will [c] follow that $c \,.\, b :: c \,.\, a$. If you ſay $b \sqsubset a$, [d] then is $\frac{c}{a} \sqsubset \frac{c}{b}$ Which is alſo againſt the *Hyp.*

(c) 7. 5.
(d) 8. 5.

Theorem 11.

Prop. XI.

a, 9.	e, 6.	c, 12.
b, 6.	f, 4.	d, 8.

Ratio's which are one and the ſame to any third, are alſo the ſame one to another.

THis Propoſition is clear enough from *Ax.* 1. 1. For if $\frac{a}{b} = \frac{e}{f} = \frac{c}{d}$ $\frac{a}{b}$ will equal $\frac{c}{d}$.

Theorem 12.

Prop. XII.

8	6	12	9
g.	k.	h.	l.
4	2	6	3
a.	b.	c.	d.
10	5		
e.	f.		

If any numbers of Magnitudes a, b, c, d; *be proportional; as one of the antecedents* a *is to one of the Conſequents* b, *ſo are all the antecedents* e, *to all the Conſequents* f.

Pro. TAke the equimultiplices of the antecedents g, h, and of the Conſequents k, l. Becauſe that as multiplex as one g is of one a, [a] ſo multiplices are g. h, of a, c; and likewiſe as multiplex as one k is of one b, ſo multiplices are all k, l, of b d. Moreover becauſe $a \,.\, b ::$ [b] $c \,.\, d$, if $g \sqsubset, =, \sqsupset k$, then will $h \sqsubset, =, \sqsupset l$, and ſo if $g \sqsubset, =, \sqsupset k$, in like manner will $g + h \sqsubset, =, \sqsupset k + l$. [c] Wherefore $a \,.\, b :: a + c,\ b + d$. *W W D.*

(a) 1. 5.
(b) *hyp.*
(c) 6 *def.* 5.

Corol.

From hence, if like proportionals be added to like proportionals, the wholes ſhall be proportional.

Theorem 13.

Prop. XIII.

12	8	6	4	10	12
g.	k.	h.	l.	p.	m.
a.	b.	c.	d.	e.	f.
6	4	3	2	5	6

If the firſt a *have the ſame Ratio to the ſecond* b, *that the third* c *to the fourth* d; *and if the third* c *have a greater proportion to the fourth* d, *then the fifth* e *to the ſixth* f, *then alſo ſhall the firſt* a *have a greater proportion to the ſecond* b, *then the fifth* e *to the ſixth* f.

TAke g,h,p, equimultiplices of a,c,e, and k, l, m, equimultiplices of b, d,f. Now becauſe that $a \,.\, b :: c \,.\, d$, if $h \sqsubset l$, [a] then is $g \sqsubset k$, but becauſe $\frac{c}{d} \sqsubset \frac{e}{f}$, [b] it may be that $h \sqsubset l$, and yet p not $\sqsubset m$, [c] Therefore $\frac{a}{b} \sqsubset \frac{e}{f}$. *W W D.*

(a) 6 *def.* 5.
(b) 8 *def.* 5.
(c) 8 *def.* 5.

Prop.

Schol.

If $\frac{c}{d} \sqsupset \frac{e}{f}$, then alſo is $\frac{a}{b} \sqsupset \frac{e}{f}$. Alſo, if $\frac{a}{b} \sqsubset \frac{c}{d} \sqsubset \frac{e}{f}$, then is $\frac{a}{b} \sqsubset \frac{e}{f}$. And if $\frac{a}{b} \sqsupset \frac{c}{d} \sqsupset \frac{e}{f}$, then is $\frac{a}{b} \sqsupset \frac{e}{f}$

Prop. XIV.

Theorem 14.

2	3	8	12
9	9	9	9
12	8	6	4
a.	b.	c.	d.

If the firſt a *have the ſame Ratio to the ſecond* b, *that the third* c *hath to the fourth* d; *and if the firſt* a *be greater than the third* c; *then ſhall the ſecond* b *be greater than the fourth* d. *But if the firſt* a *be equal to the third* c, *then the ſecond* b *ſhall be equal to the fourth* d, *but if* a *be leſſer, than is* b *alſo leſſer.*

LEt $a \sqsubset c$, [a] then $\frac{a}{b} \sqsubset \frac{c}{b}$, [b] but $\frac{a}{b} = \frac{c}{d}$; [c] Therefore $\frac{c}{d} \sqsubset \frac{c}{b}$, [e] Therefore $b \sqsubset d$. By the like way of argument, If $a \sqsupset c$, [e] then is $b \sqsupset d$. But if a be equal to c, then $c \,.\, b ::$ [e] $a \,.\, b$ [f] $:: c \,.\, d$, [g] therefore $b = d$. *W W D.*

(a) 8. 5.
(b) *hyp.*
(c) 13. 5.
(d) 10. 5.
(e) 7. 5.
(f) *hyp.*
(g) 11.5 & 9.5.

Prop. XV.

Theorem 15.

c, 25	d, 35
a, 5	b, 7

Parts a *and* b *are in the ſame Ratio, with their like multiplex* c *and* d, *if taken correſpondently.* (c . d :: a . b.)

LEt a be part of c, and b of d, c ſhall contain a ſo often as d contains b. And becauſe one of the antecedents a is to one conſequent b, [a] ſo are all the antecedents c, to all the conſequents d. Therefore $c \,.\, d :: a \,.\, b$. *W W D.*

(a) 12. 5.

Prop. XVI.

Theorem 16.

e 16,	f 20,
a 8,	b 10,
c 4,	d 5,
g 8,	h 10,

If 4 Magnitudes a, b, c, d, *be proportional, they alſo ſhall be alternately proportional.* (a . c :: b . d.)

Pro. TAke e and f equimultiplices, of a and b, alſo g and h equimultiplices of c and d. Therefore $e \,.\, f$ [a] $:: a \,.\, b ::$ [b] $c \,.\, d$ [a] $:: g \,.\, h$. Wherefore if $e \sqsubset, =, \sqsupset g$, [c] then likewiſe is $f \sqsubset, =, \sqsupset h$. [d] therefore $a \,.\, c :: b \,.\, d$. *W W D.*

(a) 15. 5.
(b) *hyp.*
(c) 11. 5. & 14. 5.
(d) 6 *def.* 5.

Schol.

Schol.

Alternate Ratio has place only then when the quantities are of the same kind. For heterogeneous quantities are not compared together.

Theorem 17.

Prop. XVII.

c 12. e 6.
a 16. b 8.
d 4. f 2.

If Magnitudes compounded be proportional, they shall also be proportional when divided. That is, if it be a . d :: b . f, *it shall be also* c . d :: e . f.

(a) 4 *def.* 5.

Pro. A and *b* are proportionals, [a] therefore of their parts *d* and *f*, they contain alike number in a like Ratio; therefore if these parts be taken from each of their respective wholes, the remainders *c* and *e* shall also contain their parts alike numbers of times: therefore it shall be as *c* . *d* :: *e* . *f*. *W W D.*

Theorem 18.

Prop. XVIII.

c 12. e 6.
a 16. b 8.
d 4. f 2.

If Magnitudes divided be proportional, the same also being compounded shall be proportional. That is, if it be d . c :: f . e, *it shall also be* a . d :: b . f.

(a) *hyp.*

Pro. [a] The parts *c*, *e*, contain parts *d*, *f*, in a like Ratio; therefore if these be added to them, the wholes *a*, *b*, also shall contain their parts *d*, *f*, in a like Ratio. *W W D.*

Theorem 19.

Prop. XIX.

d 4. f 2.
a 16. b 8.
c 12. e 6.

If the whole a, *be to the whole* b, *as the part taken away* d, *is to the part taken away* f, *then shall the residue* e *be to the residue* c, *as the whole* a *is to the whole* b.

(a) *hyp.*
(b) 16. 5.
(c) 17. 5.

Pro. [a] Seeing *a*, *b*, *d*, *f*, are proportionals; [b] it shall be *b* . *f* :: *a* . *d*. [c] Therefore it shall be as *f* . *e* :: *d* . *c*, and lastly as *f* . *d* :: *e* . *c*, that is as *a* . *b* :: *c* . *e*. *W W D.*

Corol.

If like proportionals be subtracted from like proportionals, the residues shall be proportional.

2 Hence is converse Ratio demonstrated.

(a) 16. 5.
(b) 19. 5.

Let *a* . *c* :: *b* . *e*, then *a* . *d* :: *b* . *f*. For by [a] permutation *a* . *b* :: *c* . *e*; [b] therefore *a* . *b* :: *d* . *f*, whence again by permutation *a* . *d* :: *b* . *f*. *W W D.*

Prop.

Prop. XX.

Theorem 20.

12 9 6
a, b. c.
8 . 6 4
d. e. f.

If there be 3 Magnitudes a, b, c, *and others* d, e, f, *equal to those in number which being taken two and two in each order are in the same Ratio, and if of equality the first* a *be greater then the third* c; *then shall the fourth* d *be greater than the sixth* f. *But if the first* a *be equal to the third* c, *then the fourth* d *is so to the sixth* f; *and if* a *be less than* c, *so* d *is less than* f.

(a) *hyp.*
(b) *cor.* 4 5.
(c) *hyp.* & 8. 5.
(d) *schol.* 13 5.
(e) 10. 5.
(f) 7. 5.
(g) 11. 5 & 9 5.

1. *Hyp.* Let $a \sqsubset c$. Because [a] *e* . *f* :: *b* . *c* by [b] inversion it shall be *f* . *e* :: *c* . *b*. [c] But $\frac{c}{b} \sqsupset \frac{a}{b}$. [d] Therefore $\frac{f}{e} \sqsupset \frac{a}{b}$ or $\frac{d}{c}$ [e] therefore $d \sqsubset f$. *W W D.*

2. *Hyp.* By the same way of argument if $a \sqsupset c$, it will appear that $d \sqsupset f$.

3. *Hyp.* If $a = c$. Because *f* . *e* :: *c* . *b* :: [f] *a* . *b* :: *d* . *e*; [g] therefore is $d = f$. *W W D.*

Prop. XXI.

Theorem 21.

18 12 4
a. b. c.
27 9 6
d. e. f.

If there be 3 Magnitudes a, b, c, *and others* d, e, f, *equal to them in number, which taken two and two are in the same Ratio; and their proportion inordinate* (a . b :: e . f, *and* b . c :: d . e) *and if of equality, the first* a *be greater than the third* c, *then is the fourth* d *greater than the sixth* f; *but if the first be equal to the third, then is the fourth equal to the sixth; if less, so is the other likewise.*

(a) *hyp.*
(b) 8. 5.
(c) *schol.* 13 5.
(d) 10. 5.
(e) 7. 5.
(f) *hyp.*
(g) 9. 5.

1. *Hyp.* If $a \sqsubset c$; then because [a] *d* . *e* :: *b* . *c*, therefore inversely *e* . *d* :: *c* . *b*, but $\frac{c}{b}$ [b] $\sqsupset \frac{a}{b}$, [c] therefore $\frac{e}{d} \sqsupset \frac{a}{b}$ that is $\frac{e}{f}$ [d] therefore $d \sqsubset f$.

2. *Hyp.* By the like argument if $a \sqsupset c$, then is $d \sqsupset f$.

3. *Hyp.* If $a = c$; then because *e* . *d* :: [e] *c* . *b* :: [e] *a* . *b* :: [f] *e* . *f*, [g] therefore is $d = f$. *W W D.*

Prop.

Theorem 22.

Prop. XXII.

12	9	6.	8	6	4
a.	b.	c.	d.	e.	f.
24	18	12	16	12	8
g.	h.	k.	l.	m.	n.

If there be any number of Magnitudes a, b, c, *and others equal to them in number* d, e, f, *which taken two and two are in the same Ratio*; (a . b :: d . e *and* b . c :: e . f) *they shall be in the same Ratio also by equality*, (a . c :: d . f.)

Pre. TAke *g*, *h*, *k*, equimultiplices of *a*, *b*, *c*, and *l*, *m*, *n*, equimultiplices of *d*, *e*, *f*.

(a) *hyp.*
(b) 4. 5.
(c) 20. 5.
(d) 6 *def.* 5.

Pro. Becaufe [a] *a* . *b* :: *d* . *e*; [b] therefore *g* . *h* :: *l* . *m*, and in like manner *h* . *k* :: *m* . *n*, therefore, if *g* $\sqsubset$, $=$, $\sqsupset$ *k*, [c] then is *l* $\sqsubset$, $=$, $\sqsupset$ *n*, [d] therefore *a* . *c* :: *d* . *f*.

Theorem 23.

Prop. XXIII.

18	12	4
a.	b.	c.
27	9	6
d.	e.	f.

If there be 3 *Magnitudes* a, b, c, *and others* d, e, f, *equal to them in number, which taken two and two are in the same Ratio and their proportionality inordinate* (a . b :: e . f, *and* b . c :: d . e) *they shall be in the same Ratio also by equality, (that is* a . c :: d . f.)

(a) 21. 5.
(b) 15. 5.
(c) 17 *def.* 5.
(d) 6 *def.* 5.

Pro. [a] IF *a* $\sqsubset$, $=$, $\sqsupset$ *c*; *d* fhall be $\sqsubset$, $=$, $\sqsupset$, *f*. [b] And the fame will hold in their equimultiplices. Therefore of [c] equality [d] in the fame Ratio that *a* is to *e*, fhall *d* be to *f*, that is, *a* . *c* :: *d* . *f*. *W W D.*

Corol.

* 22 & 23 5. & 20 *def.* 5.

* Ratio's compounded of the fame Ratio's, are amongft themfelves the fame; alfo the fame parts of the fame Ratio's, are among themfelves the fame.

Prop.

Prop. XXIV.

Theorem 24.

4	2	6
a.	b.	c.
3	10	15
d.	e.	f.
	14	21
	g.	h.

If the first Magnitude a *have the same Ratio to the second* b, *which the third* c, *hath to the fourth* d; *and if the fifth* e *have the same Ratio to the second* b, *which the sixth* f *hath to the fourth* d, *then shall the first compounded with the fifth* (g) *have the same Ratio to the second* b, *which the third compounded with the sixth* (h) *hath to the fourth* d.

Pro. [a] B is fuch part of either *a* or *e*, as *d* is of either *c* or *f*. [b] Therefore alfo fhall *b* be fuch a part of the compound *g*, as *d* is of the compound *h*. *W W D.*

(a) *hyp.*
(b) 18. 5.

Prop. XXV.

Theorem 25.

12	4	9	3
a.	b.	c.	d.
e.	3	f.	1

If 4 *Magnitudes be proportional* (a . b :: c . d) *the greatest* a, *and the least* d, *shall be greater than the remaining two* b, c.

Pre. FRom *a* 12 take *c* 9, and there will remain *e* 3. Alfo from *b* 4, take *d* 3, and there will remain *f* 1. Now becaufe it is *a* . *b* :: *c* . *d*. it fhall alfo be by divifion *a* . *b* :: *e* . *f*. But *a* $\sqsubset$ *b*, therefore alfo *e* $\sqsubset$ *f*. Therefore (the compound of *c* + *e* viz.) *a* + *d* $\sqsubset$ *b* (= *d* + *f*) + *c*. *W W D.*

Prop. XXVI.

Theorem 26.

8	4	5	3
a.	b.	c.	d.

If the first a *have a greater proportion to the second* b; *than the third* c, *to the fourth* d; *then contrary wise, by conversion, the second shal have a less proportion to the first, than the fourth to the third.*

THis and the other eight propofitions remaining, feeing they are not *Euclid's*, we fhall no otherwife demonftrate then by referring to the propofitions of *Euclid* beforegoing in which they are virtualy contained.

This *Prop.* is contained in the 4*th*, and 10*th*, of the 5*th*.

Prop.

Theorem 27.

Prop. XXVII.

8 4 5 3
a. b. c. d.

If the first a *have a greater proportion to the second* b, *than the third* c *to the fourth* d; *then alternately the first* a *shall have a greater proportion to the third* c, *than the second* b *to the fourth* d.

This is contained in the 16*th*, of the 5*th*.

Theorem 28.

Prop. XXVIII.

8 4 5 3
a. b. c. d.
e. 12 f. 8

If the first a *have a greater proportion to the second* b, *than the third* c *to the fourth* d, *then the first* a *compounded with the second* b, *shall have a greater proportion to the second* b, *than the third* c *compounded with the fourth* d, *to the fourth* d.

This is contained in the 18*th* Prop. of the 5*th*.

Theorem 29.

Prop. XXIX.

8 4 5 3
a. b. c. d.
e. 12 f. 8

If the first a *compounded with the second* b, *have a greater proportion to the second* b, *then the third* c *compounded with the fourth* d *hath to the fourth* d; *then by division the first* a *shall have a greater proportion to the second* b, *then the third* c *to the fourth* d.

This is contained in the 17*th* of the 5*th*.

Theorem 30.

Prop. XXX.

8 4 5 3
a. b. c. d.
e. 12 f. 8

If the first a *compounded with the second* b, *have a greater proportion to the second* b, *then the third* c *compounded with the fourth* d *hath to the fourth* d, *then by converse Ratio shall the first* a *compounded with the second* b *have a lesser Ratio to the first* a, *than the third* c *compounded with the fourth* d *shall have to the third* c.

This is contained in the 19*th* of the 5*th*.

Prop.

Prop. XXXI.

Theorem 31.

16 8 4 9 5 3
a. b. c. d. e. f.

If there be three Magnitudes a, b, c, *and others also* d, e, f, *equal to them in number, and if there be a greater proportion of the first of the former* a *to the second* b, *than there is of the first of the last* d *to their second* e, *(that is,* $\frac{a}{b} \sqsubset \frac{d}{e}$;*) and there be also a greater proportion of the second of the first Magnitudes* b, *to the third* c, *than there is of the second of the last Magnitudes* e, *to their third* f, *(that is,* $\frac{b}{c} \sqsubset \frac{e}{f}$.*) Then by equality also shall the Ratio of the first of the former Magnitudes* a *to the third* c, *be greater than the Ratio of the first of the last Magnitudes* d, *to the third* f, *(that is,* $\frac{a}{c} \sqsubset \frac{d}{f}$.*)*

This is contained in Prop. 20*th* and 22*th*.

Prop. XXXII.

Theorem 32.

16 8 5
a. b. c.
9 6 4
d. e. f.

If there be 3 Magnitudes a, b, c, *and others* d, e, f, *equal to them in number and there be a greater proportion of the first of the former Magnitudes* a, *to the second* b, *than there is of the second of the latter* e, *to the third* f, *(that is,* $\frac{a}{b} \sqsubset \frac{e}{f}$;*) and also the Ratio of the second of the former* b, *to the third* c, *be greater than the Ratio of the first of the later* d, *to the second* e, *(that is,* $\frac{b}{c} \sqsubset \frac{d}{e}$*) then by equality also shall the proportion of the first of the former* a, *to the third* c, *be greater than that of the first of the latter* d, *to the third* f, *(that is,* $\frac{a}{c} \sqsubset \frac{d}{e}$.*)*

This is contained in the 21*th* and 23*th* Prop. of the 5*th*.

Theorem 33.

Prop. XXXIII.

12	6
a.	b.
4.	3
c.	d.
8.	3
e.	f.

If the proportion of the whole a *to the whole* b, *be greater than the proportion of the part taken away* c, *to the part taken away* d; *then shall also the Ratio of the remainder* e *to that of* f, *be greater than that of the whole* a *to the whole* b.

This is contained in the 18*th*.

Theorem 34.

Prop. XXXIV.

12	8	4	6	5	3
a.	b.	c.	d.	e.	f.

If there be any number of Magnitudes a, b, c, *and others* d, e, f, *equal to them in number; and the proportion of the first of the former to the first of the latter, be greater then that of the second to the second, and that greater than the proportion of the third to the third, and so forward; all the former Magnitudes together shall have a greater Ratio to all the latter together, than all the former omitting the first, shall have to all the latter, omitting the first; but less than that of the first of the former to the first of the latter; and lastly greater than that of the last of the former, to the last of the latter,*

THis being of no use in the following demonstrations, we pass as the other 7 beforegoing.

The most notable Prop. of this Book are the 15, 16, 17, 18.

THE

THE SIXTH BOOK OF Euclid's Elements.

DEFINITIONS.

1. L*Ike Right-lined figures* are such, whose several ∠s are equal one to the other, and also their sides about the equal ∠s proportional; as *ABC*, *DEF*. For,

The ∠ *B* = *E*, and *AB* . *BC* :: *DE* . *EF*.
Also the ∠ *A* = *D*, and *BA* . *AC* :: *ED* . *DF*.
Lastly, the ∠ *C* = *F*, and *BC* . *CA* :: *EF* . *FD*.

2. *Reciprocal figures* are, when in either figure the terms are the antecedents and consequents of Ratio's

As the ▭s *BD*, *BF*: for *AB* . *BC* :: *EB* . *BG*.

3. *A Right-line AB*, is said to be cut according to extreme and mean proportion, when, as the whole *AB*, is to the greater segment *AC*, so is the greater segment *AC*, to the lesser *CB*. (*AB* . *CA* :: *CA* . *CB*.)

4. The *Altitude* of any figure, is a perpendicular line *AC*, drawn from the top *A* to the base *BD*.

5. *A Ratio*, is said to be compounded of two Ratio's, when the quantities of the Ratio's being multiplied the one into the other, do produce any Ratio.

As the Ratio of *a* to *c*, is compounded of the Ratio's of *a* to *b* and of *b* to *c*.

(a) 20. *def.* 5.
(b) 15. 5.

For $\frac{a}{b} + \frac{b}{c}$ [a] $= \frac{a}{c}$ [b] $= \frac{ab}{bc}$.

Theorem 1.

Prop. I.

Triangles ABC, DEF, *and Parallelograms* CG, DF, *which have the same height, are in proportion one to the other, as their bases* BC, EF.

(a) 3. 1.
(b) 38. 1.
(c) *sch.* 3°. 1.
(d) 6 *def.* 5.
(e) 41. 1 & 15. 5.

[a] TAke *BI* = *BC*, and *FL* = *EF*, and draw *AI*, *DL*. [b] The △ *ABC* = *ABI*; and also *DFE* = *DFL*. Therefore the △ *ACI* is as multiplex of the △ *ABC*, as the base *IC* is of the base *BC*; and the △ *DEL* as multiplex of the △ *DEF*, as the base *EL* is of *EF*. But if *IC* ⊏, =, ⊐ *EL*, [c] then is the △ *AIC* ⊏, =, ⊐ *DEL*; and therefore [d] *BC* . *EF* :: △ *ABC* . *DEF* :: [e] ▯ *CG* . *EH*. *WWD*.

Schol.

Triangles and ▯s whose bases are equal, are in such proportion as their altitudes.

Theorem 2.

Prop. II.

If to one side CB *of a* △ ABC, *be drawn a parallel Right-line* ED, *the same shall cut the sides* (AC, AB) *of the* △ *proportionally. And if the sides of the* △ *be proportionally cut, then a Right-line* ED, *joyning the points of section, shall be parallel to the remaining side of the* △ CB.

(a) 37. 1.
(b) 7. 5.
(c) 1. 6.
(d) 11. 5.
(e) 1. 6.
(f) 9. 5.
(g) 39. 1.

Hyp. 1. BEcause the △ *DEB* [a] = *DEC*, [b] therefore shall be the △ *ADE* . *DBE* :: *ADE* . *ECD*. But the △ *ADE* . *DBE* :: [c] *AD* . *DB*, and the △ *ADE* . *DEC* :: *AE* . *EC*, [d] therefore *AD* . *DB* :: *AE* . *EC*.

Hyp. 2. Because *AD* . *DB* :: *AE* . *EC*, [e] that is, as the △ *ADE* . *DBE* :: *ADE* . *ECD*; [f] therefore is the △ *DBE* = *ECD*; [g] therefore *DE* ∥ *BC*. *WWD*.

Schol.

If there be drawn many parallels to one side of any △, then all the segments of the other sides shall be proportional.

Prop.

Prop. III.

Theorem 3.

If an ∠ A, *of a* △ ABC *be bisected, and the Right-line* AD, *that bisects the* ∠, *cut the base* BC *also; then shall the segments of the base* BD, DC, *have the same Ratio that the other sides of the* △ BA, AC *have, and if the segments of the base* BD, DC *have the same Ratio, that the other sides of the* △ *have* BA, AC, *then a Right-line* AD, *drawn from the top* A *to the section* D, *shall bisect that* ∠ A *of the* △.

(a) 5. 1.
(b) 32. 1.
(c) *hyp.*
(d) 27. 1.
(e) 26. 1.
(g) 29. 1.
(h) 1. *ax.*

Pr. PRoduce *AC*, and make *AE* = *AB*, and draw *EB*.

Hyp. 1. Because *AE* = *AB*, therefore is the ∠ *ABE* [a] = *E* [b] = ½ *BAC* [c] = *DAB*; [d] therefore *DA* ∥ *EB*. [c] Wherefore *CA* . *AE* (*AB*) :: *CD* . *DB*.

Hyp. 2. Because *CA* . *AB* (*AE*) :: *CD* . *DB*, [e] is *DA* ∥ *BE*; and [g] therefore is the ∠ *CAD* = *E*; and the ∠ *DAB* [g] = *ABE* [a] = *E*. [h] Therefore the ∠ *CAD* = *DAB*. Wherefore the ∠ *CAB* is bisected. *WWD*.

Prop. IV.

Theorem 4.

Of equiangular △s ACB, DBE, *the sides are proportional which are about the equal* ∠s C *and* B (*that is,* AC . CB :: DB . BE.) *and the sides* BA, ED, *which are subtended under the equal* ∠s C *and* B, *are homologous, or of like Ratio.*

(a) 32. 1.
(b) *hyp.*
(c) 28. 1.
(d) 34. 1.
(e) 2. 6.
(f) 16. 5.
(g) 22. 5.

Pr. SEt the side *CB*, in a direct line to the side *BE*, and produce *CA* and *ED*, till they [a] meet.

Pro. Because the ∠ *C* [b] = *EBD*, shall *CF* ∥ *BD*. Also because the ∠ *CBA* [b] = *BED*; [c] therefore is *BA* ∥ *EF*. Then is *BAFD* a ▯ and [d] therefore *AF* = *BD*, and *AB* = [d] *FD*. Whence it's evident that *CA* . *AF* (*BD*) :: [e] *CB* . *BE*, [f] by permutation therefore *AC* . *CB* :: *BD* . *BE*, also *CB* . *BE* :: *FD* (*AB*) . *DE*, [f] and thence by permutation *CB* . *AB* :: *BE* . *DE*, [g] wherefore also by equality *AC* . *AB* :: *BD* . *DE*. Therefore &c.

Corol.

Hence, *AC* . *BD* :: *CB* . *BE* :: *AB* . *DE*.

Schol.

If in a △ *FCE*, there be drawn *AB* ∥ *FE* (one of the sides,) the △ *ACB* shall be like to the whole *FCE*.

Prop.

Theorem 5.

Prop. V.

If two $\triangle^s$ ABC, DEF have their sides AB, BC, proportional to DE, EF, the $\triangle^s$ are equiangular, and their $\angle^s$ (viz. D, A; E, B; F, C) equal, under which are subtended the homologous sides.

(a) 23. 1.
(b) 32. 1.
(c) 4. 6.
(d) *hyp.*
(e) 11. 5 & 9. 5.
(f) 8. 1.
(g) 32. 1.

Pro. UPon the line $\mathcal{E}F$, and at the point E, [a] make the $\angle FEG = B$, and at F make the $\angle EFG = C$; [b] whence the $\angle G = A$. Therefore $GE . EF :: $ [c] $AB . BC ::$ [d] $DE . EF$; [e] and therefore $GE = DE$. Likewise $GF . FE$ [c] $:: AC . CB ::$ [d] $DF . FE$; [e] therefore $GF = DF$. Therefore the $\triangle^s$ DEF, GEF, are mutually equilateral. [f] Therefore the $\angle D = G = A$, and the $\angle FED$ [f] $= FEG = B$, and [g] consequently the $\angle DFE = C$. Therefore &c.

Theorem 6.

Prop. VI.

If two $\triangle^s$ ABC, DEF, have one $\angle$ A equal to one $\angle$ D, and the sides about the equal $\angle^s$, A, D, proportional, (BA . AC :: ED . DF.) then those $\triangle^s$ are equiangular, and have those $\angle^s$ E, B; C, F, equal, under which are subtended the homologous sides BA, ED; AC, DF.

(a) 32. 1.
(b) 4. 6.
(c) *hyp.*
(d) 9. 5.
(e) *hyp.*
(f) *constr.*
(g) 4. 1.
(h) 32. 1.

Pre. ON the Right-line $\mathcal{E}F$ make the $\angle FEG = B$, and $EFG = C$. *Pro.* [a] Then will the $\angle G = A$. Therefore $AB . AC ::$ [b] $GE . GF ::$ [c] $DE . DF$, [d] and therefore $DE = GE$, and $DF = GF$. But the $\angle D =$ [e] $A =$ [f] G; therefore the $\angle DEF$ [g] $= G\mathcal{E}F = B$, [h] and consequently the $\angle EFD = C$. *WWD.*

Theorem 7.

Prop. VII.

If two $\triangle^s$ ABC, DEF, have one $\angle$ A, equal to one $\angle$ D, and the sides about the other $\angle^s$ ABC, E, proportional, (AB . BC :: DE . EF) and if they have both the remaining $\angle^s$ C, F, either less or not less than a Right $\angle$; then shall the $\triangle^s$ ABC, DEF, be equiangular, and have those $\angle^s$ equal about which the proportional sides are, viz. ABC, DEF.

(a) *hyp.*
(b) 32. 1.
(c) 4. 6.
(d) *hyp.*
(e) 9. 5.
(f) 5. 1.
(g) *cor.* 17. 1.
(h) *cor.* 13. 1.

Pro. LEt C and F, be less than ∟, and let, if it can be, the $\angle ABC \sqsubset E$, and make the $\angle ABG = E$. Then seeing the $\angle A$ [a] $= D$; [b] shall the $\angle AGB = F$. Therefore $AB . BG ::$ [c] $DE . EF ::$ [d] $AB . BC$; [e] therefore $BG = BC$, [f] therefore the $\angle BGC = BCG$. [g] Therefore $BGC = C$ is less than a ∟, and [h] consequently, AGB or $F \sqsubset$ ∟. which is against the Hyp. Again, let B and E be $\sqsupset$ ∟ also, then shall $BG = BC$, and [k] consequently the $\angle BGC = BCG$, and not less than ∟, [l] which is also absurd. Therefore $ACB = F$, and consequently $B = E$. *WWD.*

(k) 5. 1.
(l) 17. 1.

Theorem 8.

Prop. VIII.

If in a Right-angled $\triangle$ ABC, from the right $\angle$ BAC, there be drawn AD, a Perpendicular to the base BC; then the $\triangle^s$ (ADC, BDA) about the Perpendicular are like both to the whole $\triangle$ BAC, and also one to the other.

(a) 10 ax. 1.
(b) *hyp.*
(c) 32. 1 & 4. 6.
(d) 21. 6.

Pro. BEcause $BAC =$ [a] $ADB =$ [b] ∟, and the $\angle B$ common; the $\triangle^s$ BAC, ADB, [c] are like. By the same argument BAC, ADC, are like, [d] whence also ADB, ADC, will be like. *WWD.*

Corol.

(e) 4. 6.

1. The Perpendicular from the right $\angle$ to the base, is a mean proportion between the segments of the base. [e] For $BD . DA :: DA . DC$.

2. Either of the leggs of the ∟ is a mean proportion between the whole Hypothenusal, (or base) and that segment thereof which is adjacent to that leg. For $BC . AC :: AC . DC$, and $CB . BA :: BA . BD$.

Problem 1.

Prop. IX.

From a Right-line given AB, *to cut off any part required, as* $\frac{1}{3}$ (AG.)

(a) 3. 1.
(b) 31. 1.
(c) 2. 6.
(d) 18. 5.

Pra. FRom the point A, draw an infinite line AC any wise, in which [a] take any three equal parts AD, DE, EF, joyn FB, to which from D, [b] draw the parallel DG; and the thing is done.
Pro. For $GB . AG ::$ [c] $FD . AD$; whence by [d] composition, $AB . AG :: AF . AD$. Therefore seeing $AD = \frac{1}{3} AF$, shall $AG = \frac{1}{3} AB$. *WWDn.*

Problem 2.

Prop. X.

To divide an undivided Right-line given AB, *as another given line* AC, *was cut (in* D *and* E.)

(a) 31. 1.

Pra. DRaw BC joyning the extremities of the line divided, and of the line not divided; and to that line from the points E, D, [a] draw the parallels $\mathcal{E}G$, DF, meeting with the Right-line that is to be cut, in G and F; then the thing is done.

Pro.

(a) 31. 1.
(b) 2. 6.
(c) 34.1 & 7.5.

Pro. For let *DH* be drawn [a] parallel to *AB*. Then *AD . DE* :: [b] *AF . FG*, and *DE . EC* [b] :: *DI . IH* :: [c] *FG . GB*. *WWDn.*

Schol.

Hence is learnt with any extent of the compasses, to cut a Right-line given into as many equal parts as you please. As admit, I would divide the Right-line *AG* into 6 equal parts. Draw an infinite line *AR*, and another *GH*, parallel thereto; then take any extent in the Compasses, and lay it off 5 times from *A* to *N, O, P, Q, R*; and also 5 times from *G*, *viz.* to *M, L, K, I, H*; (always one less than are required in *AG*;) and draw *HN, IO, KP, LQ, MR*; these lines so drawn shall cut the Right-line given *AG* into 6 parts, as required.

Problem 3.

Prop. XI.

Two Right-lines AB, BC, *being given, to find a third proportional.*

Pra. WIth the two given lines make the Right-angle *ABC*, also another Right-angle *ACD*, by raising *CD* ⊥ *AC*, and extending it till it meet *AB* protracted in *D*. Then it's evident by *cor.* 8. 6. that *BC* is a mean proportional, and consequently, *AB . BC* :: *BC . BD*. *WWDn.*

Problem 4.

Prop. XII.

Three Right-lines AB, BC, AD, *being given, to find a fourth proportional* DE.

Pra. OF the lines *AB, BC* (placed in a direct line) and *AD*, make an ∠ *DAC*, and joyn *BD*, and lastly, draw *CE* ∥ *BD*, so shall *DE* be a fourth proportional required.

(a) 2. 6. *Pro.* For *CE* ∥ *BD*: [a] therefore *AB . BC* :: *AD . DE*. *WWDn.*

Problem 5.

Prop. XIII.

Two Right lines AB, BC, *being given, to find a mean proportional* BD.

Pra. PLace *AB, BC*, in a direct-line, and on the whole line *AC*, describe the semicircle *ADC*. On *B* raise the perpendicular *BD*, meeting with the periphery in *D*, so is *BD* the mean required.

(a) 31. 3.
(b) cor. 8. 6.

Pro. For letting *AD, CD*, be drawn, seeing from the [a] ∟ of the Right-angled △ *ADC*, is drawn the perpendicular *DB*, [b] therefore *AB . BD* :: *BD . BC*. *WWDn.*

Corol

Corol.

A Right-line drawn from any point in the Circumference of a Circle Perpendicular to the diameter, is a mean proportional between the segments of the diameter.

Prop. XIV. Theorem 9.

Equal ▯s BD, BF, *having one* ∠ ABC, *equal to one* EBG, *have the sides* AB, BG, EB, BC; *which are about the equal* ∠s *reciprocal: And these* ▯s *which have one* ∠ *equal to one* ∠, *and the sides which are about the equal* ∠s *reciprocal, are equal.*

Pro. LEt the sides *AB, BG*, about the equal ∠s make one Right-line; [a] wherefore *EB, BC*, shall do the same. Let *FG, DC*, be produced till they meet.

Hyp. 1. *AB . BG* [b] :: *BD . BH* :: [c] *BF . BH* :: [d] *BE . BC*. [e] Therefore &c.

Hyp. 2. *BD . BH* :: [f] *AB . BG* :: [g] *BE . BC* :: [h] *BF . BH*. [k] Therefore the ▯ *BD* = *BF*. *WWD.*

(a) 15. 1.
(b) 1. 6.
(c) 7. 5.
(d) 1. 6.
(e) 11. 5.
(f) 1. 6.
(g) hyp.
(h) 1. 6.
(k) 11. 9. 5.

Prop. XV. Theorem 10.

Equal △s ABC, DBE, *having one* ∠ ABC, *equal to one* ∠ DBE, *their sides which are about the equal* ∠s *are reciprocal* (AB . BE :: DB . BC) *and those* △s *which have one* ∠ ABC *equal to one* DBE, *and have also the sides that are about the equal* ∠s *reciprocal, are equal.*

Pra. LEt the sides *CB, BD*, which are about the equal ∠s be set in a strait-line; [a] then *ABE* is also a Right-line. Let *CE* be drawn.

Hyp. 1. *AB . BE* :: [b] △ *ABC . CBE* [c] :: *DBE . CBE* :: [b] *DB . BC*; [d] therefore &c.

Hyp. 2. △ *ABC . CBE* :: *AB . BE* :: [e] *DB . BC* [b] :: *DBE . CBE*; [f] therefore the △ *ABC* = *DBE*. *WWD.*

(a) 15. 1.
(b) 1. 6.
(c) 7. 5.
(d) 11. 5.
(e) hyp.
(f) 11. & 9. 5.

Theorem 11.

Prop. XVI.

If 4 Right-lines A, G, F, B, *be proportional, the Rectangle* AC, *comprehended under the extremes* AB, BC, *is equal to the Rectangle* FG, *comprehended under the means* EF, FG. *And if the Rectangle* AC, *comprehended under the extremes* AB, BC, *be equal to the Rectangle* FG, *comprehended under the means* FE, EG, *then are these 4 Right-lines proportional.*

(a) 10 ax. 1. (b) 14. 6. (c) hyp. (d) 14. 6.

Hyp. 1. THe $\angle^s$ B and E are right, and [a] consequently equal, and by hypothesis $AB \,.\, EG :: FE \,.\, CB$. [b] therefore the $\square$ $AC = FG$.

Hyp. 2. The $\square$ AC [c] $= FG$, and the $\angle B = E$; [d] therefore $AB \,.\, EG :: EF \,.\, CB$. *WWD.*

Cor. I.

Hence, it's easie to reduce one Rectangle into another of a given length or breadth.

Theorem 12.

Prop. XVII.

If 3 Right-lines A, F, B, *be proportional, the Rectangle* AC, *comprehended under the extremes* AB, BC, *is equal to the Square* EG, *made of the mean* F. *And if the Rectangle* AC, *comprehended under the extremes* AB, BC, *be equal to the Square* EG, *made of the mean* F, *then the three lines are proportional. Take* GF = FE.

(a) hyp. (b) 16. 6 (c) 29 def. 1. (d) hyp. (e) 16. 6.

Hyp. 1. A$B \,.\, FE ::$ [a] $FE\,(GF) \,.\, CB$; therefore the $\square$ AC [b] $= GE = FEq.$

Hyp. 2. The $\square$ AC [d] $= \square EG = FEq.$ [e] Therefore $AB \,.\, FE :: FG\,(EF) \,.\, BC$. *WWD.*

Corol.

Let $a \times b = c^2$, then $a \,.\, c :: c \,.\, b$.

Problem 6.

Prop. XVIII.

Upon a Right-line given AB, *to describe a Right-lined figure* CDEFG, *like and a like situate to a Right-lined figure given* ABHIK.

(a) 23. 1.

REsolve the Right-lined figure given into $\triangle^s$, by drawing CF, DF. [a] Make the $\angle IAB = FCD$, [a] and the $\angle IBA = FDC$, [a] and the $\angle IBH = FDE$, and $BIH = DFE$, also $IAK = FCG$, and $AIK = CFG$. Then shall $ABHIK$ be the Right-lined figure sought.

(b) constr. (c) 32. 1. (d) 2 ax. 1. (e) 4. 6. (f) 22. 5.

Pro. For seeing the $\angle IAB$ [b] $= FCD$, and IBA [b] $= FDC$; shall the $\angle AIB$ [c] $= CFD$, and because IBH [b] $= FDE$, and BIH [b] $= DFE$, shall BHI [c] $= DEF$; also because IAK [b] $= FCG$, and AIK [b] $= CFG$, shall AKI [c] $= CGF$. And because IAB [b] $= FCD$, and IAK [b] $= FCG$, shall the whole BAK [d] $= DCG$; and because ABI [b] $= FCD$, and IBH [b] $= FDE$, shall ABH [d] $= CDE$; and lastly, because HIB [b] $= EFD$, and BIA [b] $= DFC$, and AIK [b] $= CFG$, shall HIK [c] $= EFG$. The Polygones therefore are mutually equiangular. And because the $\triangle^s$ are equiangular, therefore $AB \,.\, BH$ [e] $:: CD \,.\, DE$; and $KA \,.\, KI ::$ [e] $GC \,.\, GF$, &c. [f] whence by equality $KA \,.\, AB :: :: GC \,.\, CD$, &c. therefore also like scituate. *WWD.*

Theorem 13.

Prop. XIX.

Like $\triangle^s$ ABC, DEF, *are in duplicate Ratio of their homologous sides.*

(a) 11. 6. (b) cor. 4. 6. (c) constr. (d) 15. 6. (g) 15. 6. (e) 1. 6. (f) 10 def. 5. (g) 11. 5.

IF the $\triangle^s$ be equal it's evident without farther demonstration. But when unequal, its thus, demonstrated.

[a] Make $BC \,.\, EF :: EF \,.\, BG$, and let AG be drawn. Then because $AB \,.\, DE ::$ [b] $BC \,.\, EF$ [c] $:: EF \,.\, BG$, and the $\angle B = E$, [d] therefore is the $\triangle ABG = DEF$. But the $\triangle ABC \,.\, ABG ::$ [e] $BC \,.\, BG$, and [f] $\frac{BC}{BG} = \frac{BC^2}{EF}$; therefore $\frac{ABC}{ABG}$ that is $\frac{ABC}{DEF}$ [g] $= \frac{BC^2}{EF}$ that is in a duplicate Ratio. *WWD.*

Corol.

If three Right-lines a, b, c, be proportional, then as the first is to the third, so is a $\triangle$ made upon the first a, to a $\triangle$ like and a like described upon the second b: or so is a $\triangle$ described upon the second b, to a $\triangle$ like and a like described on the third c.

Theorem 14.

Prop. XX.

Like Polygones are divided into equal $\triangle^s$, *both equal in number and homologous to the wholes: and the Polygones have a double Ratio one to the other, of what one homologous side hath to the other homologous side.*

(a) hyp. (b) 6. 6.

Pro. 1. THe $\angle K$ [a] $= G$, and $KI \,.\, KA :: FG \,.\, GC$; [b] therefore the $\triangle^s$ IKA, and FGC are equiangular. After the same manner are the $\triangle^s$ IHB, FED, like. Therefore seeing the $\angle KAI$ [b] $= GCF$, and

and the △s IBH [b] $= FDE$, and the whole $\angle KAB =$ [c] GCD, and ABH [c] $= CDE$, the remaining $\angle IAB$ [d] $= FCD$, and $IBA = FDC$; and consequently AIB [e] $= CFD$. Therefore the △s AIB, CFD are like, therefore &c.

(c) hyp.
(d) 3 ax. 1.
(e) 32. 1.

(f) 19. 6. 2. Because the △s KAI, GCF are like, [f] therefore is $\frac{KAI}{GCF} = \frac{KA^2}{GC^2}$. For the same reason is $\frac{AIB}{CFD} = \frac{AB^2}{CD^2}$; lastly $\frac{BHI}{DEF} = \frac{BH^2}{DE^2}$. Now because that

(g) hyp. & 16. 5. $KA . GC$ [g] $:: AB . CD$ [g] $:: BH . DE$; [h] therefore is the △ KAI
(h) schol. 23. 5. $. GCF :: ABI . CFD :: BHI . DEF$ [k] $::$ the Polygone $KABHI$
(k) 12. 5. $. GCDEF :: \frac{KA^2}{GC}$.

Corol.

1. If 3 Right-lines be proportional; then as the first is to the third, so is a Polygone made upon the first, to a Polygone made upon the second, like and a like described, or so is a Polygone described upon the second to a Polygone made on the third, like and a like described.

By which is discovered a method of inlarging or diminishing, any Right-lined figure in a Ratio given: As if you would make a pentagone quintuple of that pentagone whereof AB is the side, then betwixt AB, and $5\ AB$, find a mean proportion, * upon which make a pentagone like that given, and it shall be quintuple of the pentagone given.

* 13. 6.

2. If the homologous sides of like figures be known, then will the proportion of the figures be evident, *viz.* by finding a third proportional.

Prop. XXI.

Theorem 15.

Right-lined figures ABC, DEF, *which are like to the same Right-lined figures* GHI, *are also like one to the other.*

(a) 1 def. 6. *Pro.* For the $\angle A$ [a] $= G$ [a] $= D$; and the $\angle C$ [a] $= I$ [a] $= F$; and the $\angle B$ [a] $= H$ [a] $= E$. Also [a] $BA . BC :: GH . HI :: DE . EF$, and [a] $BC . CA :: HI . IG :: EF . FD$, and $BA . AC :: HG . GI :: ED . DF$. Therefore [a] ABC, DEF, are like. *WWD.*

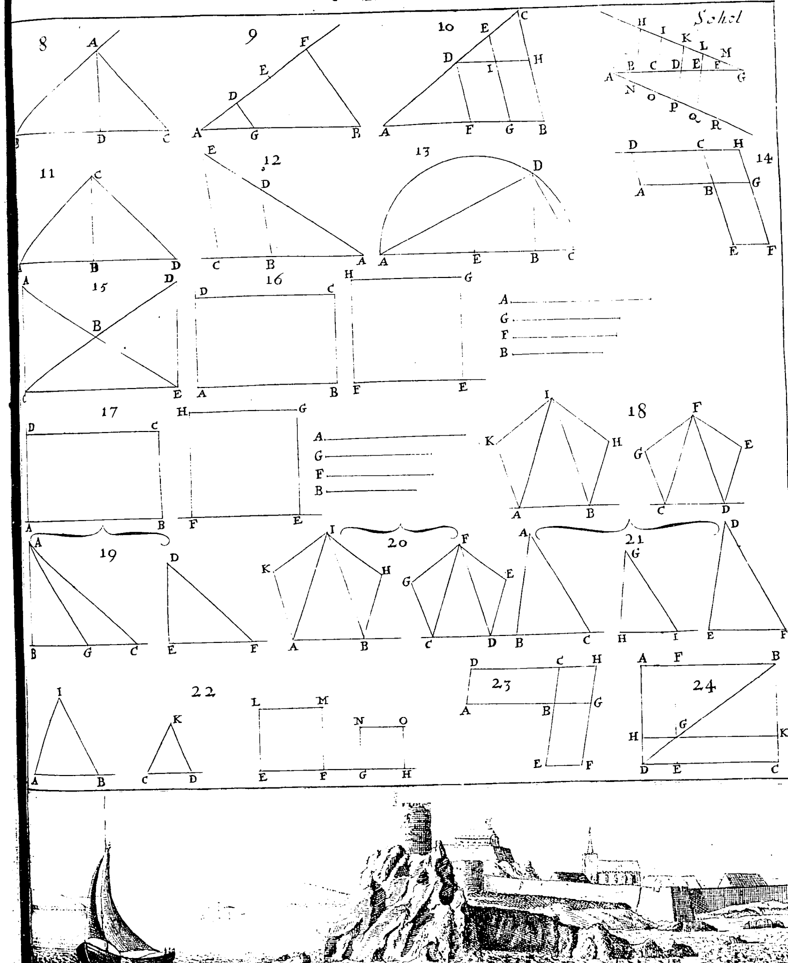
Prop. XXII.

Theorem 16.

If 4 Right-lines AB, CD, EF, GH, *be proportional: the Right-lined figures also* ABI, CDK, EM, *and* NH, *described upon them being like and alike situate, shall be proportional. And if the Right-lined figures described upon the lines, like and a like situate, be proportional, then the Right-lines also shall be proportional.*

(a) 19. 6. Hyp. 1. $\frac{AIB}{CDK}$ [a] $= \frac{AB^2}{CD^2}$ [a] $= \frac{EF^2}{GH^2}$ [a] $= \frac{EM}{GO}$. [b] Therefore $ABI . CDK :: EM . GO$. *Hyp. 2.*

6th Book..



Eucl: Page 100.

Hyp. 2. $\frac{AB^2}{CD}{}^a = \frac{ABI}{CDK}{}^b = \frac{EM}{GO} = {}^c\frac{EF^2}{GH}$. Therefore $AB . CD :: EF$ (b) *hyp.*
GH. *WWD.* (c) 20. 6.

Prop. XXIII. Theorem 17.

Equiangular ▱s AC, BF, *have the Ratio one to the other, which is compounded of their sides* AB, *to* BG, *and* EB, *to* BC.

Pre. Let the sides about the equal ∠s *B*, be [a] set in a direct line, and let the ▱ *BH*, be compleated.

Pro. Then is the Ratio of *AC*, to *BF*, equal to the Ratio of [a] *AC*, to (a) *sch.* 15. 1
BH, together with that of *BH*, to *BF*, as also to the Ratio of [c] *AB*, to (b) 20 *def.* 5.
BG, together with the Ratio of *CB*, to *BE*. That is, $\frac{AC}{BF} = \frac{AC}{BH} + \frac{BH}{BF}$ (c) 1. 6.

${}^c = \frac{AB}{BG} + \frac{BC}{BE}$. *WWD.*

Corol.

1. Hence, and from 34. 1. Triangles which have one ∠ equal, have a Ratio compounded of the Ratio's of the Right-lines containing the equal ∠.

2. All ▭s and ▱s have their Ratio one to the other, compounded of the Ratio's of base to base, and altitude to altitude. And after the same manner in △s.

Prop. XXIV. Theorem 18.

In every ▱ AC, *the* ▱s FK, HE, *which are about the diameter* DB, *are like to the whole, and also one to the other.*

Pro. Seeing the ▱s *HE*, *FK*, have each of them one ∠ common with the whole; [a] therefore they are equiangular to the whole, and also one (a) 29. 1.
to the other.

Also both the △s *BAD*, *GHD*, *BFG*, [a] and the △s *BCD*, *GED*, *BKG*, are mutually equiangular; [b] therefore the sides are proportional, (b) 4. 6.
and [c] consequently constitute ▱s like to the whole, and also one to the other. (c) 1 *def.* 6.
WWD.

Prop. XXV. Problem 7.

To a Right-lined figure given A, *to describe another figure* L *like and alike situate, which also shall be equal to another Right-lined figure given* B.

Pra. On the side of the given figure *AD*, [a] make the Rect-angle $CE = A$; (a) 45. 1.
[b] Also upon *DE*, make the ▭ $DK = B$; Between *C*, and *DG*, (b) 44. 1.
[c] find a mean proportion $DH = IN$; [d] upon *IN* make the figure *L*, like and (c) 13. 6.
in a like position to the Right-lined figure given *A*, then shall the Right-lined (d) 18. 6.
figure $L = B$, and be like the figure *A*. *WWDn.* (e) *cor.* 20. 6.

Pro. For $A(CE) . L :: {}^e CD . DG :: {}^f CE . DK$. Therefore $L {}^g = DK {}^h = B$. (f) 1. 6.
WWDn. (g) 14. 5.
(h) *constr.*

Prop.

Theorem 19.

Prop. XXVI.

If from a Parallelogram BD, *be taken away another* ▯FG, *like unto the whole, and in like manner set, having also an* ∠FBG, *common with it; then is that* ▯ *about the same diagonal* BD, *with the whole.*

(a) 24. 6.
(b) 1 def. 6.
(c) hyp.
(d) 9. 5.
(f) 9 ax.

If you deny *BD*, to be the common diagonal, let *BHD* be it, cutting *GI* in *H*, and draw *HE* ∥ *BG*. Then are the ▯s *GE*, *AC*,[a] like; [b]therefore *BG* . *GH* :: *BA* . *AD* :: [c]*GB* . *IG*, and [d]consequently *GH* = *GI*. [f]Which is absurd.

Theorem 20.

Prop. XXVII.

Of all ▯s AD, AG, *applied to the same Right-line* AB, *and wanting in figure by* ▯s CE, KI *like and alike situate to the* ▯AD, *described upon half* AC; *the greatest is that* AD, *which is applyed to the half, being like to the defect* KI. *That is, let there be described on* AC, *the half of the line* AB, *a* ▯AD, *so that it may want of the whole* AE, *a* ▯CE, *equal and like to* AD. *Also to any other segment* AK, *let there be applied another* ▯AG, *wanting so much as the* ▯KI, *like to* CE, *that is standing about the diameter* BGD. *I say* AG ⊏ AD.

(a) 43. 1.
(b) 2 ax.
(c) 36. 1.
(d) 2 ax.
(e) 9 ax.

Pro. Because *GE*[a] = *GC*, and *KI* added common, [b]thence is *KE* = *CI*[c] = *AM*. add *CG* common, [d]then is *AG* = the Gnomon *MBL*. But the Gnomon *MBL*[e] ⊏ *CE* (*AD*.) Therefore *AG* ⊏ *AD*. *WWD.*

Problem 8.

Prop. XXVIII.

Upon a Right-line given AB, *to apply a* ▯AI, *equal to a Right-lined figure given* C, *deficient by a* ▯ON, *which is like to another* ▯ *given* D* *But it's requisite that the Right-lined figure given* C, *whereunto the* ▯ *to be applied* AI, *must be equal, be not greater then the* ▯AF, *which is upon the half-line, seeing the defects must be like, namely the defect of the* ▯AF, *which is applied to the half-line, and the defect of the* ▯D, *to be applied, whose defect is to be like to the* ▯ *given.*

* 27 6.

(a) 18. 6.
(b) sch. 45. 1.
(c) 25. 6.

Pra. Bisect *AB* in *E*; upon *EB*, [a]make the ▯*EG*, like to the ▯*D*; and compleat the ▯*BH*, and [b]let *EG* = *C* + *V*. [c]Make the ▯*QR* = *V*, and like to the ▯ given *D*, or *EG*, draw the diameter *FB*; make *KF* = *PQ*, and *FL* = *PR*; through *I* and *L*, draw the parallels *MN*, *LO*, Then is the ▯*AI*, that which was sought.

Pro.

Pro. The ▯s *D*, *EG*, *KL*, *QR*, *ON*, are all [d]like one to the other, and the ▯*EG* = [e]*QR* + *C* = [e]*KL* + *C*. [f]Wherefore *C* = the Gnomon *KBL*[g] = *AK* + *IG* = [h]*AK* + *EI* = *AI*. *WWDn.*

(d) constr. & 24. 6.
(e) constr.
(f) 3 ax.
(g) 2 ax.
(h) 43. 1.

Problem 9.

Prop. XXIX.

Upon a Right-line given AB, *to apply a* ▯ *equal to a Right-lined figure given* C, *exceeding by a* ▯PO, *which shall be like to another* ▯ *given* D.

Pra. Bisect *AB*, in *E*. Upon *EB*, [a]make an ▯*EC*, like to *D* given. And [b]make the ▯*IK* = *EC* + *C*, and like to *D* given, or *EC*. Make *FEN* = [c]*HI*; and [c]*FCM* = *KH*. Through *N* and *M*, draw the ∥s *MR*, *QR*, and *AQ* ∥ *MR*, produce *ABO*, *CBP*. Draw the diameter *FBR*. Then is *AR*, the ▯ required.

Pro. The ▯s *D*, *IK*, *NM*, *EC*, are [d]like; [e]therefore the ▯*PO*, is like to the ▯*NM*, or *D*. Also *NM*[d] = *IK*[d] = *EC* + *C*; [g]therefore *C* = to the Gnomon *ERC*. But *AN*[h] = *NB*[k] = *BM*; [l]therefore *C* = *AR*. *WWDn.*

(a) 18. 6.
(b) 25 6.
(c) 3. 1.
(d) constr.
(e) 24. 6.
(g) 3 ax.
(h) 36. 1.
(k) 43. 1.
(l) 2 & 1 ax.

Problem 10.

Prop. XXX.

To cut a terminate Right-line given AB, *into* G, *according to extreme and mean Ratio. That is,* AB . AG :: AG . GB.

(a) 11. 2.
(b) 17. 6.

Pra.[a] Cut *AB*, in *G*, in such wise that *AB* × *BG* = *AGq*. [b]Then *BA* . *AG* :: *AG* . *BG*. *WWD.*

Theorem 21.

Prop. XXXI.

In a Right-angled △BAC, *any figure* BD, *described upon the side* BC, *subtending the Right-angle* BAC, *is equal to the figures* BG, AI, *described upon the sides* BA, AC, *containing the Right* ∠, *like and alike situate to the former* BD.

(a) hyp.
(b) 23. 6.
(c) 47. 1.
(d) 9 5.

Pro. The figures *FA*, *AI*, *BD*, are [a]like, [b]therefore in a duplicate Ratio of their sides. Also the Squares described on these sides or lines *BA*, *AC*, *BC*, [b]are in a duplicate Ratio of their sides. Therefore seeing *BAq* + *ACq* [c]= *BCq*, shall the figures *FA* + *AI* [d]= *BD*. *WWD.*

Corol.

Hence, may be learned how to add or subtract any like figures, *viz.* by using the same method that was followed in adding and subtracting Squares. *Sch.* 47, 1.

Prop.

Theorem 21.

Prop. XXXII.

If 2 △s ABC, DCE, *having two sides* AB, AC, *proportional to two sides* DC, DE, *be so compounded or set together at one* ∠ ACD, *that their homologous sides* AB, DC; AC, DE, *be parallel, then the remaining sides* BC, CE, *of these* △s *shall be found placed in one strait line.*

(a) 29. 1.
(b) *hyp.*
(c) 6. 6.
(d) 2 *ax.*
(e) 32. 1.
(f) 1 *ax.*
(g) 14. 1.

Pro. THe $\angle A$ [a] $= ACD$ [a] $= D$. And $AB \,.\, AC ::$ [b] $DC \,.\, DE$, [c] therefore the $\angle B = DCE$. Therefore the $\angle B + A$ [d] $= ACE$. But the $\angle B + A + ACB$ [e] $= 2$ ∟s. [f] Therefore the $\angle ACE + ACB = 2$ ∟s; therefore BCE, is a Right-line. *WWD.*

Theorem 22.

Prop. XXXIII.

In equal Circles ABCA, EFGL, *the* ∠s A, E, D, H, *have the same Ratio with their peripheries* BC, FG, *on which they insist; whether the* ∠s *be at the centers* D, H, *or at the circumferences* A, E; *and in like sort are the sectors* BDC, FHG, *because described upon the centers.*

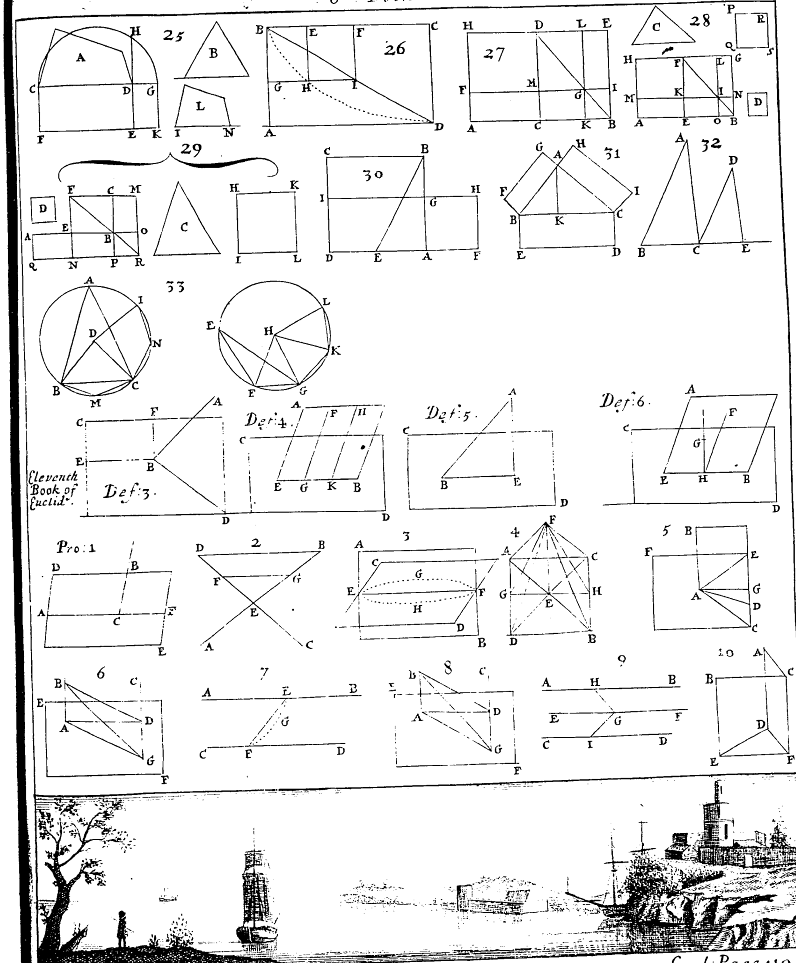
Pre. DRaw the Right-lines BC, FG; Make $CI = CB$, and $GK = FG = KL$, and joyn DI, HK, HL.

(a) 28. 3.
(b) 27. 3.
Pro. The arch BC [a] $= CI$, [a] also the arch $FG = GK, = KL$; [b] therefore the $\angle BDC = CDI$, [b] and the $\angle FHG = GHK = KHL$. Therefore the arch BI, is as multiplex of the arch BC, as the $\angle BDI$, is of the $\angle BDC$. And in like manner is the arch FL, as multiplex of the arch FG, as the $\angle FHL$, is of the $\angle FHG$. But if the arch $BI \sqsubset, =, \sqsupset FL$,
(c) 27. 3.
(d) 6 *def.* 5.
(e) 15. 5.
(f) 20. 3.
[c] then likewise is the $\angle BDI \sqsubset, =, \sqsupset FHL$. Therefore is the arch $BC \,.\, FG ::$ [d] the $\angle BDC \,.\, FHG$ [e] $:: \frac{BDC}{2} \,.\, \frac{FHG}{2}$ [f] $:: A \,.\, E$. *WWD.*

(g) 24. 3.
(h) 4. 1.
(k) 2 *ax.*
Secondly, the $\angle BMC$ [g] $= CNI$; [g] and therefore the segment $BCM = CIN$, [h] also the $\triangle BDC = CDI$; [k] wherefore the sector $BDCM = CDIN$. After the same manner are the sectors $FHG = GHK, = KHL$. Therefore since accordingly as the arch $BI \sqsubset, =, \sqsupset FGL$,
(l) 6 *def.* 5.
so is likewise the sector $BDI \sqsubset, =, \sqsupset FHL$; [l] thence shall be the sector $BDC \,.\, FHG ::$ the arch $BC \,.\, FG$. *WWD.*

Corol.

6th Book.



Corol.

1. As a fector is to a fector, fo is ∠ to ∠.

2. The ∠ at the center is to 4 ∟s, as the arch on which it infifts, to the whole circumference.

3. Arches of unequal ○s which fubtend equal ∠s, whether at the centers, or at the circumference, are like.

4. Two femidiameters cut off, like arches from concentrick Circumferences.

The moft notable Prop. of this Book are the 1, 2, 3, 4, 5, 6, 8, 13, 14, 16, 19, 31.

THE

ELEVENTH AND TWELFTH

BOOKS

OF

Euclid's Elements.

Printed at LONDON, by *Anne Godbid*,
and *John Playford*, 1680.

THE ELEVENTH BOOK OF Euclid's Elements.

DEFINITIONS.

1. A *Solid* is that which hath length, breadth, and thickness.

2. The *term*, or extreme, of a solid is a Superficies.

3. A *Right-line* AB, is perpendicular to a Plane CD, when it makes Right-angles ABD, ABE, ABF, with all the Right-lines BD, BE, BF, that touch it, and are drawn in the said Plane.

4. A *Plane* AB, is perpendicular to a Plane CD, when the Right-lines FG, HK, drawn in one Plane AB, to the line of common section of the two Planes EB, and making Right-angles therewith, do also make Right-angles with the other Plane CD.

5. The *inclination* of a Right-line AB, to a Plane CD, is, when a perpendicular AE, is drawn from A, the highest point of that line AB, to the Plane CD, and another line EB, drawn from the point E, which the perpendicular AE, makes in the Plane CD, to the end B, of the said line AB, which is in the same Plane, whereby the angle is acute ABE, which is contained under the insisting line AB, and the line drawn in the Plane EB.

6. The

6. The *inclination* of a *Plane AB* to a Plane *CD*, is an acute angle *FHG* contained under the Right-lines *FH*, *GH*, which being drawn in either of the Planes *AB*, *CD* to the same point *H*, of the common section *BE*, make Right-angles *FHB*, *GHB*, with the common section *BE*.

7. *Planes* are said to be inclined to other Planes in the same manner, when the said angles of inclination are equal one to another.

8. *Parallel Planes* are those which being prolonged never meet.

9. *Like solid figures* are such as are contained under like Planes equal in number.

10 *Equal and like solid figures* are such as are contained under like Planes, equal both in multitude and magnitude.

11. A *solid angle* is the inclination of more than two Right-lines which touch one another, and are not in the same superficies.

Or thus;

A *solid angle* is that which is contained under more than two Plane angles not being in the same superficies, but consisting all at one point.

12. A *Pyramid* is a solid figure comprehended under divers Planes set upon one Plane, (which is the base of the Pyramid,) and gather together to one point.

13. A *Prism* is a solid figure contained under Planes, whereof the two opposite are equal, like and parallel; but the others are parallelograms.

14. A *Sphere* is a solid figure made when the diameter of a semicircle abiding unmoved, the semicircle is turned round about, till it return to the same place from whence it began to be moved.

Corol.

Hence, all the rayes drawn from the center to the superficies of a Sphere, are equal amongst themselves.

15. The *Axis* of a *Sphere*, is that fixed Right-line, about which the semicircle is moved.

16. The *Center* of a *Sphere*, is the same point with that of the semicircle.

17. The *Diameter* of a *Sphere*, is a Right-line drawn through the center, and terminated on either side in the superficies of the sphere.

18. A *Cone* is a figure made, when one side of a rectangled triangle (*viz.* one of those that contain the Right-angle) remaining fixed, the triangle is turned round about till it return to the place from whence it first moved. And if the fixed Right-line be equal to the other which containeth the Right-angle, then the Cone is a rectangled Cone: but if it be less, it is an obtuse-angled Cone; if greater, an acute angled Cone.

19. The *Axis* of a *Cone* is that fix'd line about which the triangle is moved.

20. The *Base* of a *Cone* is the circle, which is described by the Right-line moved about.

21. A *Cylinder* is a figure made by the moving round of a Right-angled parallelogram, one of the sides thereof, (namely which contains the Right-angle) abiding fix'd, till the parallelogram be turned about to the same place, where it began to move.

22. The *Axis* of a *Cylinder* is that quiescent Right-line, about which the parallelogram is turned.

23. And the *Bases* of a *Cylinder* are the circles which are described by the two opposite sides in their motion.

24. Like *Cones* and *Cylinders*, are they, both whose Axes and Diameters of their Bases are proportional.

25. A *Cube* is a solid figure contained under six equal Squares.

26. A *Tetraedron* is a solid figure contained under four equal and equilateral triangles.

27. An *Octaedron* is a solid figure contained under eight equal and equilateral triangles.

28. A *Dodecaedron* is a solid figure contained under twelve equal, equilateral and equiangular Pentagones.

29. An *Icosaedron* is a solid figure contained under twenty equal and equilateral triangles.

30. A *Parallelipipedon* is a solid figure contained under six quadrilateral figures, whereof those which are opposite are parallel.

31. A *Solid figure* is said to be inscribed in a solid figure, when all the angles of the figure inscribed are comprehended either within the angles, or in the sides, or in the planes of the figure wherein it is inscribed.

32. Likewise a *Solid figure* is then said to be circumscribed about a solid figure, when either the angles, or sides, or Planes of the circumscribed figure, touch all the angles of the figure which it contains.

Prop. I.

One part AC, *of a Right-line, cannot be in a Plane superficies, and another part* CB, *elevated upward.*

PRoduce *AC*, in the Plane directly to *F*. If you conceive *CB*, to be drawn strait from *AC*, then two Right-lines *AB*, *AF*, have one common segment *AC*. [a] *Which is impossible.* (a) 10 *ax.* 1.

Prop. II.

If two Right-lines AB, CD, *cut one another, they are in the same Plane: And every Triangle* DEB, *is in one and the same Plane.*

FOr imagine *EFG*, part of the triangle *DEB*, to be in one Plane, and the part *FDGB*, to be in another; then *EF*, part of the Right-line *ED* is in a Plane, and the other part elevated upwards. [a] *Which is Absurd.*

There-

Therefore the triangle *EDB*, is in one and the same Plane; and so also
(a) 1. 11. are the Right-lines *ED*, *EB*; [a] wherefore the whole lines *AB*, *DC*, are in one Plane. *Which was to be demonstrated.*

Prop. III.

If two planes AB, CD, *cut one the other, their common section* EF, *is a Right-line.*

(a) 1 post. 1. IF *EF*, the common section be not a Right-line, [a] then in the plane *AB*, draw the Right-line *EGF*, [a] and in the plane *CD*, the Right-line *EHF*.
(b) 14 ax. 1. Therefore two Right-lines *EGF*, *EHF*, include a superficies. [b] *Which is Absurd.*

Prop. IV.

If a Right-line EF, *be at Right-angles erected upon two lines* AB, CD, *cutting one the other, at the common section* E; *it shall also be at Right-angles to the plane* ACBD, *drawn by the said lines.*

TAke *EA*, *EC*, *EB*, *ED*, equal one to the other, and joyn the Right-lines *AC*, *CB*, *BD*, *AD*. Draw any Right-line *GH* through
(a) constr. *E*, and joyn *FA*, *FC*, *FD*, *FB*, *FG*, *FH*. Because *AE* is [a] $=$ *EB*,
(b) 15. 1. and *DE* [a] $=$ *EC*, and the angle *AED* [b] $=$ *CEB*, [c] therefore *AD* is
(c) 4. 1. $=$ *CB*, [c] and likewise *AC* $=$ *DB*. [d] Therefore *AD* is parallel to *CB*, [d] and
(d) sch. 34. 1. *AC* to *DB*. [e] Wherefore the angle *GAE* $=$ *EBH*, and the angle *AGE*
(e) 29. 1. $=$ *EHB*. But also *AE* [f] $=$ *EB*. [g] Therefore *GE* $=$ *EH*, [g] and *AG* $=$
(f) constr. *BH*. Whence by reason of the right angles, by the hyp. and so equal,
(g) 26. 1. at *E*, [h] the bases *FA*, *FC*, *FB*, *FD*, are equal. Therefore the triangles
(h) 4. 1. *ADF*, *FBC*, are equilateral one to another. [k] and thence the angle
(k) 8. 1. *DAF* $=$ *BCF*. Therefore in the triangles *AGF*, *FBH*, the sides *FG*,
(l) 4. 1. *FH*, [l] are equal; and so by consequence the triangles *FEG*, and *FEH*,
(m) 8. 1. are mutually equilateral. [m] Therefore the angles *FEG*, *FEH*, are equal,
(n) 10 def. 1. and [n] so Right-angles. In like manner, *FE*, makes Right-angles with all
(o) 3 def. 11. the lines drawn through *E*, in the plane *ADBC*, [o] and is therefore perpendicular to the said plane.

Prop. V.

If a Right-line AB, *be erected perpendicular to three Right-lines* AC, AD, *touching one the other at the common section, those three lines are in the same plane.*

(a) 2. 11. FOr *AC*, *AD*, [a] are in one plane *FC*; [a] and *AD*, *AE*, are in one plane *BE*. Which if you conceive to be several planes, then let their inter-
(b) 3. 11. section [b] be the Rright-line *AG*; therefore because *BA* by the Hypoth. is perpendicular to the Right-lines *AC*, *AD*. [c] And so to the plane *FC*, [d] it (c) 4. 11.
is also perpendicular to the Right-line *AG*. Therefore (since [a] that *AB* (d) 3 def. 11.
is in the same plane with *AC*, *AE*) the angles *BAG*, *BAE*, are right angles, and consequently equal, the part and the whole. *Which is Absurd.*

Prop. VI.

If two Right-lines AB, DC, *be erected perpendicular to one and the same plane* EF, *those Right-lines* AB, DC, *are parallel one to the other.*

DRaw *AD*, whereunto let *DG* $=$ *AB* be perpendicular in the plane *EF*, and joyn *BD*, *BG*, *AG*. Being in the triangles *BAD*, *ADG*,
the angles *DAB*, *ADG* [a] are Right-angles, and *AB* [b] $=$ *DG*, and *AD* (a) hyp.
is common, [c] therefore *BD* is $=$ *AG*. Whence in the triangles *AGB*, (b) constr.
BGD, equilateral one to the other, the angle *BAG* is [d] $=$ *BDG*; of (c) 4. 1.
which being *BAG* is a Right-angle, *BDG* shall be so also. But the angle (d) 8. 1.
GDC is supposed right, therefore the Right-line *GD* is perpendicular to
the three lines *DA*, *DB*, *CD*. [e] Which are therefore in the same plane (e) 5. 11.
[f] wherein *AB* is. Wherefore since *AB* and *CD* are in the same plane, and (f) 2. 11.
the internal angles *BAD*, *CDA*, are Right-angles, [g] *AB* and *CD* shall (g) 28. 1.
be parallels. *WW to be Dem.*

Prop. VII.

If there be two parallel Right-lines AB, CD, *and any points* E, F, *be taken in both of them, the line* EF, *which is joined at these points, is in the same plane with the parallels* ABCD.

LEt the plane in which *AB*, *CD*, are, be cut by another plane at the points *E*, *F*. Then if *EF* is not in the plane *ABCD*, it shall not
be the common section. Therefore let *EGF* be the common section; which
[a] then is a Right-line. Therefore two Right-lines *EF*, *EGF*, include a (a) 3. 11.
superficies. [b] *Which is Absurd.* (b) 14. ax. 1

Prop. VIII.

If there be two parallel Right-lines AB, CD, *whereof one* AB, *is perpendicular to a plane* EF. *Then the other* CD *shall be perpendicular to the same plane* EF.

THe preparation and demonstration of the sixth of this Book being transferr'd hither; the angles *GDA*, and *GDB* are Right-angles: [a] there-

Q

(a) 4. 11. (b) 7. 11. (c) 3 def. 11. (d) 29. 1. (e) 4. 11.

[a] therefore *G D* is perpendicular to the plane, wherein are *A D*, *D B* ([b] in which also *A B*, *C D*, are.) [c] Therefore *G D* is perpendicular to *C D*. But the angle *C D A* is also [d] a Right-angle. [e] Therefore *G D* is perpendicular to the plane *E F*. *W.W. to be Dem.*

Prop. IX.

Right-lines (AB, CD) *which are parallel to the same Right-line* EF, *but not in the same plane with it, are also parallel one to the other.*

(a) 4. 11. (b) 8. 11. (c) 6. 11.

IN the plane of the parallels *A B*, *E F*, draw *H G* perpendicular to *E F*; also in the plane of the parallels *E F*, *C D*, draw *I G* perpendicular to *E F*, [a] therefore *E G* is perpendicular to the plane wherein *H G*, *G I* are; and *A H*, *C I*, are perpendicular to the same plane. [c] Therefore *A H* and *C I* are parallels. *W. W. to be Dem.*

Prop. X.

If two Right-lines AB, AC, *touching one another be parallel to two other Right-lines* ED, DF, *touching one another, and not being in the same plane, those Right-lines contain equal angles,* BAC, EDF.

(a) hyp. and constr. (b) 33. 1. (c) 2 ax. 1. & 30. 1. (d) 33. 1. (e) 8. 1.

LEt *A B*, *A C*, *D E*, *D F*, be equal one to the other, and draw *A D*, *B C*, *E F*, *B E*, *C F*. Being *A B*, *D E*, [a] are parallels and equal, [b] also *B E*, *A D*, are parallels and equal. In like manner *C F*, *A D*, are parallels and equal; [c] therefore also *B E*, *F C*, are parallels and equal. [d] Therefore *B C*, *E F* are equal. Wherefore since the triangles *B A C*, *E D F*, are of equal sides one to the other, the angles *B A C*, *E D F* [e] shall be equal. *W. W. to be Dem.*

Prop. XI.

From a Point given on high A, *to draw a Right-line* AI, *perpendicular to a plane below* BC.

(a) 12. 1. (b) 11. 1.

IN the plane *B C* draw any line *D E*; to which from the point *A* [a] draw the perpendicular *A F*, and [b] likewise *F H* in the plane *B C*, cutting the said line *D E* at *F*; [a] then let fall *A I* perpendicular to *F H*. Which *A I*, shall be perpendicular to the plane *B C*.

For

For through *I* [c] let *K I L*, be drawn parallel to *D E*. Because *D E* [d] is perpendicular to *A F*, and *F H*, [e] therefore *D E*, shall be perpendicular to the plane *I F A*. And so also *K L* [f] is perpendicular to the same plane. [g] Therefore the angle *K I A* is a Right-angle; but the angle *A I F* is also [h] a Right-angle. [i] Therefore *A I* is perpendicular to the plane *B C*. *W. W. to be Done.*

(c) 31. 1. (d) constr. (e) 4. 11. (f) 8. 11. (g) 3 def. 11. (h) constr. (i) 4. 11.

Prop. XII.

In a plane given BC, *at a point given therein* A, *to erect a perpendicular line* AF.

FRom some point without the plane, *D*, [a] draw *D E* perpendicular to the said plane *B C*; and joyning the points *A*, *E*, by a line *A E*, [b] draw *A F* parallel to *D E*. [c] It is apparent that *A F* is perpendicular to the plane *B C*. *W. W. to be Done.*

(a) 11. 11. (b) 31. 1. (c) 8. 11.

This and the preceding problem are practically performed by applying two Squares to the point given; as appears by 4. 11.

Prop. XIII.

At a point given C, *in a plane given* AB, *two Right-lines* CD, CE, *cannot be erected perpendicular on the same side.*

FOr both *C D*, and *C E*, [a] should then be perpendicular to the plane *A B*, and consequently parallels; which is repugnant to the definition of parallel lines.

(a) 6. 11.

Prop. XIV.

Planes CD, FE, *to which the same Right-line* AB, *is perpendicular, are parallel.*

IF you deny this; then let the planes *C D*, *F E*, meet, so that their common section be the Right-line *G H*; in which take any point *I*, draw to it the Right-lines *I A*, *I B*, in the said planes. Whereby in the triangle *I A B*, two angles *I A B*, *I B A* [a] are Right-angles. [b] *Which is Absurd.*

(a) hyp. and 3 def. 11. (b) 17. 1.

Q 2 Prop.

Prop. XV.

If two Right-lines AB, AC, *touching one another, be parallel to two other Right-lines* DE, DF, *touching one the other, and not being in the same plane with them, the planes* BAC, EDF, *drawn by those Right-lines, are parallel one to the other.*

(a) 11. 11. FRom *A* [a] draw *AG*, perpendicular to the plane *EF*. [b] And let *GH*,
(b) 31. 1. *GI*, be parallel to *DE*, *DF*; [c] these also shall be parallel to *AB*, *AC*.
(c) 30. 1. Therefore since the angles *IGA*, *HGA*, [d] are Right-angles, also *CAG*,
(d) 3 *def.* 11. *BAG*, [e] shall be Right-angles. [f] Therefore *GA* is perpendicular to the
(e) 29. 1. plane *BC*; but the same is perpendicular to the plane *EF*. [h] Therefore
(f) 4. 11. the planes *BC*, *EF*, are parallel. *W. W. to be Dem.*
(g) *constr.*
(h) 24. 11.

Prop. XVI.

If two parallel planes AB, CD, *be cut by some other plane* HEIGF, *their common sections* EH, GF, *are parallel one to the other.*

FOr if they be conceived to be otherwise, being in the same plane that cuts them, they will meet somewhere, if produced; suppose in *I*;
(a) 1. 11. wherefore since the whole lines *HEI*, *FGI*, [a] are in the planes *AD*, *CD*, being produced, the planes also shall meet. *Contrary to the Hyp.*

Prop. XVII.

If two Right-lines ALB, CMD, *be cut by parallel planes* EF, GH, IK; *they shall be cut proportionally*, (AL . LB :: CM . MD.)

LEt the Right-lines *AC*, *BD*, be drawn in the planes *EF*, *IK*; as also *AD* passing through the plane *GH* in the point *N*. And join *NL*, *LM*; the planes of the triangles *ADC*, *ADB*, make the sections
(a) 16 11. *BD*, *LN*, and *AC*, *NM* [a] parallels. Therefore *AL . LB :: AN*
(b) 2. 6. *. ND* [b] *:: CM . MD*. *W. W. to be Dem.*

Prop.

Prop. XVIII.

If a Right-line AB, *be perpendicular to some plane* CD, *all the planes extended by that Right-line* AB (EF, &c.) *shall be perpendicular to the same plane* CD.

LEt there be some plane *EF* drawn by *AB*, making the section *EG* with the plane *CD*; from some point whereof *H*, [a] draw *HI* parallel to (a) 31. 1.
AB, in the plane *EF*; [b] then shall *HI* be perpendicular to the plane *CD*, (b) 8. 11.
and so likewise any other lines, that are perpendicular to *EG*; [c] therefore (c) 4 *def.* 11.
the plane *EF* is perpendicular to the plane *CD*; and by the same reason any other planes drawn by *AB* shall be perpendicular to *EF*. *W. W. to be Dem.*

Prop. XIX.

If two planes AB, CD, *cutting one the other, be perpendicular to some plane* GH, *their line of common section* EF *shall be perpendicular to the same plane* (GH.)

BEcause the planes *AB*, *CD*, are taken perpendicular to the plane *GH*, it appears by 4. *def.* 11. that out of the point *F* there may be drawn in both planes *AB*, *CD*, a perpendicular to the plane *GH*. Which shall [a] be but one; and therefore the common section of the said planes. (a) 13. 11.
W. W. to be Dem.

Prop. XX.

If a solid angle ABCD, *be contained under three plane angles*, BAD, DAC, BAC, *any two of them howsoever taken are greater than the third.*

IF the three angles are equal, the assertion is evident; if unequal, then let the greatest be *BAC*; from whence [a] take away *BAE* = *BAD*, (a) 23. 1.
and make *AD* = *AE*; and also draw *BEC*, *BD*, *DC*. (b) *constr.*
Because the side *BA* is common, and *AD* [b] = *AE*; and the angle *BAE* (c) 4. 1.
[b] = *BAD*, [c] thence is *BE* = *BD*. But *BD* + *DC* is [d] $\sqsubset$ *BC*; [e] therefore *DC* $\sqsubset$ *EC*. Wherefore since *AD* [b] = *AE*, and the side *AC* is (d) 20. 1.
common, and *DC* $\sqsubset$ *EC*; [f] the angle *CAD* shall be $\sqsubset$ *EAC*; [g] there- (e) 5 *ax.* 1. (f) 25. 1.
fore the angle *BAD* + *CAD* $\sqsubset$ *BAC*. *W. W. to be Dem.* (g) 4. *ax.* 1.

Prop.

Prop. XXI.

Every solid angle A, *is contained under less angles than four plane Right-angles.*

(a) 32. 1. and sch. 32. 1. (b) 20. 11. (c) 5 ax. 1.

For let a plane any wise cutting the sides of the solid angle *A*, make a many-sided figure *BCDE*, and as many triangles *ABC*, *ACD*, *ADE*, *AEB*. I denote all the angles of the Polygone by *X*; and I term the sum of the angles at the bases of the triangles *Y*. Wherefore $X + 4$ Right-ang. [a] $= Y + A$: but being that (of the angles at *B*) [b] the angle $ABE + ABC$ is $\sqsubset$ *CBE*, and the same is true also of the angles at *C*, at *D*, and at *E*, [c] it is manifest that *Y* is $\sqsubset$ *X*. And consequently *A* shall be $\sqsupset$ 4 Right-angles. *W. W. to be Dem.*

Prop. XXII.

If there be three plane angles A, B, HCI, *whereof two howsoever taken are greater than the third, and the Right-lines which contain them be equal* AD, AE, FB, &c. *then of the Right-lines* DE, FG, HI, *coupling those equal Right-lines together, it is possible to make a triangle.*

(a) 22. 1. (b) 23. 1. (c) 4. 1. (d) hyp. (e) 24. 1. (f) 20. 1.

A Triangle may be [a] made of them, if any two be greater than the third: but they are so. For [b] make the angle $HCK = B$, and $CK = CH$, and draw *HK*, *IK*. [c] Thence $KH = FG$; and because the angle *KCI* [d] $\sqsubset$ *A*. [e] Therefore $KI \sqsubset DE$; but KI [f] $\sqsupset HI + KH$ (*FG*.) therefore $DE \sqsupset HI + FG$. By the like argument any two may be proved greater than the third; and consequently [a] it is possible to make a triangle of them. *W. W. to be Dem.*

Prop. XXIII.

* 21. 11.

To make a solid angle MHIK, *of three plane angles* A, B, C, *whereof two howsoever taken are greater than the third.* * *But it is necessary that those three angles be less than four Right-angles.*

(a) 22. 11. and 21. 1. (b) 5. 4. * See Clavius. (c) sch. 47. 1. (d) 12. 11. (e) 3. def. 11.

Make *AD*, *AE*, *BE*, *BF*, *CF*, *CG*, equal one to the other; and of the subtended lines *DE*, *EF*, *FG*, (that is, of the equal lines *HI*, *IK*, *KH*,) [a] make the triangle *HKI*; about which [b] describe the circle *LHKI*. * But because *AD* is $\sqsubset$ *HL*; [c] let ADq be $= HLq + LMq$. [d] And let *LM* be perpendicular to the plane of the circle *HKI*; and draw *HM*, *KM*, *IM*. Wherefore since the angle *HLM*; [e] is a Right-

(f) 47. 1. (g) constr. (h) constr. (k) 8. 1. (l) constr. and 8. 1. (m) 21. 1. * 4 cor. 13. 1.

Right-angle, [f] thence is $MHq = HLq + LMq$ [g] $= ADq$. Therefore $MH = AD$. By the same reason *MK*, *MI*, *AD*, (that is *AE*, *EB*, &c.) are equal; therefore since $HM = AD$, and $MI = AE$, and DE [h] $= HI$, [k] the angle *A* shall be $= HMI$, [k] as likewise the angle $IMK = B$, [k] and the angle $HMK = C$; wherefore a solid angle is made at *M* of the three given plane angles. *W. W. to be Done.* *AD* is assumed to be $\sqsubset$ *HL*. But this is manifest. For if *AD* be $=$ or $\sqsupset$ *HL*, then is the angle *A* [l] $=$ [m] or $\sqsubset$ *HLI*. In like manner shall *B* be equal or $\sqsubset$ *HLK*, and $C =$ or $\sqsubset$ *KLI*; wherefore $A + B + C$ * shall either equal or exceed four right angles, *contrary to the Hypoth.* therefore rather let *AD* be $\sqsubset$ *HL*. *W. W. to be Dem.*

Prop. XXIV.

If a solid AB *be contained under parallel planes, the opposit planes thereof* (AG, DB, &c.) *are like and equal parallelograms.*

(a) 16. 11. (b) 35 def. 1. (c) 10. 11. (d) 34. 1. (e) 7. 5. (g) 6. 6. (h) 4. 1. (k) 6 ax. 1.

The plane *AC* cutting the parallel planes *AG*, *DB*, [a] makes the sections *AH*, *DC*, parallels; and by the same reason *AD*, *HC* are parallels. Therefore *ADCH* is a pgr. By the like argument the other planes of the parallelepipedon are [b] pgrs. wherefore being *AF* is parallel to *HG*, and *AD* to *HC*, [c] the angle *FAD* shall be $= CGH$; therefore because AF [d] $= HG$, and AD [d] $= HC$, and so $AF . AD :: HG . HC$; [e] the triangles *FAD*, *GHC*, [g] are like and [h] equal; and consequently the pgrs. *AE*, *HB*, are like and [k] equal; and the same may be shewn of the rest opposite planes. Therefore, &c.

Prop. XXV.

If a solid Parallelepipedon ABCD, *be cut by a plane* EF, *parallel to the opposite planes* AD, BC; *then as the base* AH *is to the base* BH, *so shall solid* AHD *be to solid* BHC.

(a) 36. 1. and 1. def. 6. (b) 24. 11. (c) 10 def. 11. (d) 24. 11. and 9. def. 11. (e) 6 def. 5.

Conceive the Parallelepipedon to be extended on either side; and take $AI = AE$, and $BK = EB$, and put the planes *IQ*, *KP*, parallel to the planes *AD*, *BC*; then the pgrs. *IM*, *AH*, and [a] *DL*, *DG*, [b] and *IQ*, *AD*, *EF*, &c. are [a] like and equal; [c] wherefore the Parallelepipedon *AQ* is $= AF$; and by the same reason the Parallelepipedon $BP = BF$; therefore the solids *IF*, *EP*, are as multiplex of the solids *AF*, *EC*, as the bases *IH*, *KH*, are of the bases *AH*, *BH*. And if the basis *IH* be $\sqsubset, =, \sqsupset$ *KH*, [d] likewise shall the solid *IE* be $\sqsubset, =, \sqsupset$ *EP*, [e] consequently $AH . BH :: AF . EC$. *W. W. to be Dem.*

The same may be accommodated to all sort of prisms, whence

Corol.

Corol.

If any prism whatsoever be cut by a plane parallel to the opposite planes, the section shall be a figure equal and like to the opposite planes.

Prop. XXVI.

Upon a Right-line given AB, *and at a point given in it* A, *to make a solid angle* AHIL *equal to a solid angle given* CDEF.

(a) 11. 11. FRom some point *F* [a] draw *FG* perpendicular to the plane *DCE*, and draw the Right-lines *DF*, *FE*, *EG*, *GD*, *CG*. Make $AH = CD$, and the angle $HAI = DCE$, and $AI = CE$; and in the plane *HAI* make the angle $HAK = DCG$, and $AK = CG$; then erect *KL* perpendicular to the plane *HAI*, and let KL be $= GF$. And draw *AL*, then *AHIL* shall be a solid angle equal to that given *CDEF*. For the construction of this do's wholly resemble the framing of that, as may easily appear to any that examine it.

Prop. XXVII.

Upon a Right-line given AB, *to describe a Parallelepipedon* AK, *like, and in like manner situate, with a solid Parallelepipedon given* CD.

(a) 26. 11. OF the plane angles, *BAH*, *HAI*, *BAI*, which are equal to *FCE*, *ECG*, *FCG*, [a] make the solid angle *A* equal to the solid angle *C*.
(b) 12. 6. Also [b] make $FC . CE :: BA . AH$, [b] and $CE . CG :: AH . AI$,
(c) 22. 5. ([c] whence of equallity $FC . CG :: BA . AI$) and finish the Parallelepipedon *AK*, which shall be like to that which is given.

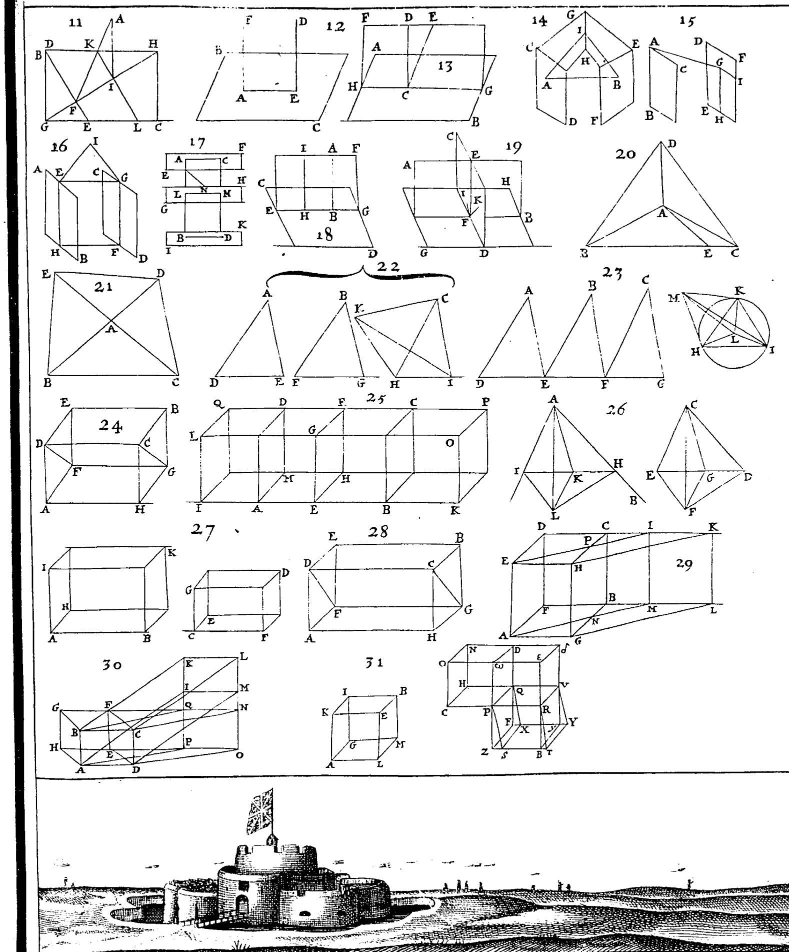
(d) 1 *def.* 6. For by the construction, the Pgr. [d] *BH* is like to *FE*, and [d] *HI* to *EG*,
(e) 14. 11. and [d] *BI* to *FG*, and [e] so the opposites of these to the opposites of them: therefore the six planes of the solid *AK*, are like to the six planes of the
(f) 9 *def.* 11. solid *CD*, [f] and consequently *AK*, *CD*, are like solids. *W. W. to be Done.*

Prop. XXVIII.

If a solid Parallelepipedon AB, *be cut by a plane* FGCD, *drawn by the diagonal lines* DF, CG, *of the opposite planes* AE, HB, *that solid* AB, *shall be equally bisected by the plane* FGCD.

(a) 24. 11. FOr because *DC*, *FG*, are [a] equal and parallels, [b] the plane *FGCD*,
(b) 34. 1. is a Pgr. and being [a] the Pgrs. *AE*, *HB*, are equal and like, [b] also the triangles *AFD*, *HGC*, *CGB*, *DFE*; are equal and like. But

Eleventh Book.



Eucl: Page 126.

But the Pgrs. *AC*, *AG*, are equal and like to *F B* and *F D*; therefore all the planes of the prism *FGC DAH*, are equal and like to all the planes of the prism *F G C D E B*, and [c] consequently this prism is equal to that. (c) 9 *def.* 11.
W. W. to be Dem.

Prop. XXIX.

Solid Parallelepipedons AGHEFBCD, AGH EMLKI, *being constituded upon the same base* AGHE, *and * in the same height, whose insisting lines* AF, AM, *are placed in the same Right-lines* AG, FL, *are equal one to the other.*

* *i.e.* between the Parallel planes *AGH-E*, *F L K D*, and so understand it in the foll.

FOr [a] if from the equal prisms *AF ME DI*, *GB L HC K*, the common prism *NB MPC I*, be taken away, and the solid *AGNEHR* [b] be added, the Parallelepipedon *AGHEFBCD* shall be = *AGHEMLKI.* (a) 10 *def.* 11. *and* 35. 1. (b) 3 *and* 2 *ax.* 1.
W. W. to be Dem.

Prop. XXX.

Solid Parallelepipedons ADBCHEFG, ADCBIMLK, *being constituted upon the same base* ADBC, *and in the same height, whose insisting lines* AH, AI, *are not placed in the same Right-lines, are equal one to the other.*

FOr produce the Right-lines *HEO*, *GFN*, and *LMO*, *KIP*; and draw *AP*, *DO*, *BQ*, *CN*; [a] then shall *DC*, *AB*, *HG*, *EF*, *PQ*, *ON*, be as well equal and parallel one to the other as *AD*, *HE*, *GF*, *BC*, *KL*, *IM*, *QN*, *PO*. [b] Wherefore the Parallelepipedon *ADCBPONQ* shall be equal to either Parallelepipedon *ADCBHEFG*, *ADCBIMLK*; and [c] consequently these two are equal one to the other. *W. W. to be Dem.* (a) 34. 1. (b) 29. 11. (c) 1 *ax.* 1.

Prop. XXXI.

* by height understand the Perpendicular drawn from the plane of the base to the opposite plane.

Solid Parallelepipedons, ALEKGMBI, CPωOHQDN, *being constituted upon equal bases* ALEK, CPωO, *and * in the same height are equal one to the other.*

FIrst, let the Parallelepipedons *AB*, *CD*, have the sides perpendicular to the bases; and at the side *CP* being produced, [a] make the Pgr. *PRTS* equal and like to the Pgr. *KϵLA*; [b] and so the Parallelepipedon *PRTS QVYX*, equal and like to the Parallelepipedon *AB*. Produce *OωE*, *NDδ*, *ωPZ*, *DQF*, *ERB*, *δVγ*, *TSZ*, *YXF*; and draw *Eδ*, *Bγ*, *ZF*. (a) 18. 6. (b) 27. 11. *and* 10 *def.* 11.

(c) 30 *def.* 11. (d) *hyp.* and 35. 1. (e) 25. 11. The planes *OεδN*, *CRVH*, *ZTΥF*; [c] are parallels one to the other; [d] and the Pgrs. *ALEK*, *CDωO*, *PRTS*, *PRBZ* are equal. Therefore since the Parallelepipedon *CD* . *PVδω* :: Pgr. *Cω(PRBZ)Pε* [e] :: Parallelepipedon *PRBZQVγF* . *PVδω*; the Parallelepipedon *CD*,
(f) 9. 5. (g) 29. 11. (h) *constr.* [f] shall be = *PRBZQVγF* [g] = *PRVQSTΥX* [h] = *AB*. *W.W. to be Dem.*

But if the Parallelepipedons *AB*, *CD*, have sides oblique to the base, then on the same bases, and in the same height place Parallelepipedons whose
(k) 29. 11. sides are perpendicular to the base. [k] They shall be equal to one another, and
(m) 1 *ax.* 1. those that are oblique [m] whence, also the oblique Parallelepipedons *AB*, *CD* are equal. *W.W. to be Dem.*

Prop. XXXII.

Solid Parallelepipodons ABCD, EFGL, *of the same height, are one to the other, as their bases,* AB, EF.

(a) 45. 1. (b) 31. 1. (c) 31. 11. (d) 25. 11. PRoduce *EHI*, [a] and make the Pgr. *FI* = *AB*, and [b] compleat the Parallepp. *FINM*. It is clear that the Parallepp. *FINM*. ([c] *ABCD*.) *EFGL* [d] :: *FI(AB.)EF*. *W.W. to be Dem.*

Prop. XXXIII.

Like Solid Parallelepipedons, ABCD, EFGH, *are in tripled proportion one to the other, of that in which their homologous sides, or of like proportion* AI, EK, *are.*

(a) 3. 1. (b) 27. 11. (c) 31. 1. (d) *hyp.* (e) 1. 6. PRoduce the Right-lines *AIL*, *DIO*, *BIN*, and [a] make *IL*, *IO*, *IN*, equal to *EK*, *KH*, *KF*, [b] and so the Parallepp. *IXMT* equal and like to the Parallepp. *EFGH*. [c] Let the Parallepps. *IXPB*, *DLΥQ* be finished. [d] Then shall be *AL* . *IL(EK)* :: *DI* . *IO(HK)* :: *BI* . *IN* . *KF*; [e] that is the Pgr. *AD* . *DL* :: *DL* . *IX* :: *BO* . *IT*
(f) 32. 11. (g) *constr.* (h) 10. *def.* 5. (k) 1. 6. [f] *i.e.* the Parallepp. *ABCD* . *DLQΥ* :: *DLQΥ* . *IXBP* :: *IXBP* . *IXMT*([g] *EFGH*.) [h] therefore the proportion of *ABCD* to *EFGH* is triple of the proportion of *ABCD* to *DLQΥ*, [k] or of *AI* to *EK*. *W.W. to be Dem.*

Corol.

Hence it appears, that if four Right-lines be continually proportional, as the first is to the fourth, so is a Parallelepipedon described on the first to a Parallelepipedon described on the second, being like and in like manner described.

Prop. XXXIV.

In equal solid Parallelepipedons ADCB, EHGF, *the bases and altitudes are reciprocal* (AD . EH :: EG . AC.) *And solid Parallelepipedons,* ADCB, EHGF, *whose bases and altitudes are reciprocal, are equal.*

FIrst, let the sides *CB*, *GE* be perpendicular to the bases; then if the altitudes of the solids are equal, the bases also shall be equal; and the thing is clear. But if the altitudes are unequal, from the greater *EG* (a) 3. 11.
[a] take *EI* = *AC*, and at *I* [b] draw the plane *IK* parallel to the base *EH*. (b) 31. 1.
Then, (c) 32. 11. (d) 17. 5. (e) 1. 6.

1. *Hyp.* *AD* . *EH* [c] :: Parallepp. *ADCB* . *EHIK* [d] :: Parallepp. (f) *constr.*
EHGF . *EHIK* [e] :: *GL* . *IL* [e] :: *GE* . *IE*. ([f] *AC*.) [g] it is plain (g) 11. 5.
therefore that *AD* . *EH* :: *GE* . *AC*. *W.W. to be Dem.* (h) 32. 11. (k) *hyp.* (l) 1. 6.

2. *Hyp.* *ADCB* . *EHIK* [h] :: *AD* . *EH* [k] :: *EG* . *EI* [l] :: *GL* (m) 32. 11.
. *LI* [m] :: Parallepp. *EHGF* . *EHIK*. [n] Wherefore the Parallelepi- (n) 9. 5.
pedon *ADCB* = *EHGF*. *W.W. to be Dem.*

Moreover, let the sides be oblique to the bases, and erect right Parallelepipedons upon the same bases in the same altitude; the oblique Parallepps shall be equal to them. Wherefore since by the first part, the bases and altitudes of those be reciprocal, the bases and altitudes of these also shall be reciprocal. *W.W. to be Dem.*

Corol.

All that hath been demonstrated of Parallelepipedons in the 29, 30, 31, 32, 33, 34. Prop. *does also agree to triangular prisms, which are half Parallelepipedons, as appears by* Prop. 28. Therefore,

1. Triangular prisms are of equal height with their bases.

2. If they have the same or equal bases, and the same altitude, they are equal.

3. If they be like, their proportion is treble to that of their sides of like proportion.

4. If they be equal, their bases and altitudes are reciprocal; and if their bases and altitudes be reciprocal, they are also equal.

Prop. XXXV.

If there be two plane angles BAC, EDF, *equal, and from the points of those angles two Right-lines* AG, DH, *be elevated on high, containing equal angles with the lines first given, each to his correspondent angle (the angle* GAB = HDE, *and* GAC = HDF.) *and if in those elevated lines* AG, DH, *some points be taken,* G, H; *and from these points perpendicular lines* GI, HK, *drawn to the planes* BAC, EDF, *in which the angles first given are, and Right-lines* AI, DK, *be drawn to the angles first given from the points* I, K, *which are made by the perpendiculars in the planes; these Right-lines with the elevated lines,* AG, DH; *shall contain equal angles* GAM, HDK.

MAke DH, AL, equal; and GI, LM parallels; and MC to AC,
MB to AB, KF to DF, KE to DE, perpendicular; and draw
(a) 8. 11. the Right-lines BC, LB, LC, and EF, HF, HE; [a] and LM is per-
(b) 3 *def.* 11. pendicular to the plane BAC; [b] wherefore the angles LMC, LMA,
LMB; and by the same reason the angles HKF, HKD, HKE are
Right-angles. Therefore ALq [c] $= LMq + AMq$ [c] $= LMq + CMq$
(c) 47. 1. $+ ACq$ [c] $= LCq + ACq$; [d] therefore the angle ACL is a Right-angle.
(d) 48. 1. Again ALq [e] $= LMq + MAq$ [e] $= LMq + BMq + BAq = BLq$
(e) 47. 1. $+ BAq$; [d] therefore the angle ABL is also a Right-angle. By the like
(f) 26. 1. inference the angles DFH, DEH, are Right-angles; [f] therefore AB
(g) 4. 1. $= DE$, [f] and $BL = EH$, [f] and $AC = DF$, and $CL = FH$; [g] wherefore
(h) 1 *ax.* 1. also $BC = EF$, [g] and the angle $ABC = DEF$, [g] and the angle ACB
(k) 26. 1. $= DFE$; [h] whence the other Right angles CBM, BCM, are equal to
(l) 47. 1. the other FEK, EFK, [k] therefore $CM = FK$; [l] and so also $AM =$
(m) *constr.* DK; therefore if from LAq [m] $= HDq$ be taken away $AMq = DKq$,
(n) 47. 1. *and* 3. *ax.* [n] there remains $LMq = HKq$; wherefore the triangles LAM, HDK
(o) 8. 1. are equilateral one to the other; [o] therefore the angle $LAM = HDK$.
W. W. to be Dem.

Corol.

Therefore, if there be two plane angles equal, from whose points equal Right-lines be elevated on high, containing equal angles with the lines first given, each to each; perpendiculars drawn from the extreme points of those elevated lines to the planes of the angles first given, are equal one to the other; *viz.* $LM = HK$.

Prop.

Prop. XXXVI.

If there be three Right-lines DE, DG, DF, *proportional, the solid parallelepipedon* DH, *made of them, is equal to the solid parallelepipedon* IN, *made of the middle line* DG, (IL) *which is also equilateral, and equiangular to the said parallepp.* DH.

BEcause $DE . LK$ [a] $:: IL . DF$; [b] the pgr. IK shall be $= FE$; (a) *hyp.*
and by reason of the equality of the plane angles at E and I, and of (b) 14. 6.
the lines GD, IM, also the altitudes of the Parallelepipedons are equal
by the prec. *Corol.* [c] therefore the parallepps are equal one to the other. (c) 31. 11.
W. W. to be Dem.

Prop. XXXVII.

If there be four Right-lines A, B, C, D, *proportional, the solid Parallelepipedons* A, B, C, D, *being like, and in like sort described from them, shall be proportional. And if the solid Parallelepipedons, being like and in like sort described, be proportional* (A . B :: C . D.) *Then those Right-lines* A, B, C, D, *shall be proportional.*

FOr the proportions of the paralleepps. [a] are triple of those of the (a) 33. 11.
lines; therefore if $A . B :: C . D$; [b] then shall the parallepp. A. (b) *sch.* 23. 5.
parallepp. B :: parallepp. C . parallepp. D; and so also contrarily.

Prop. XXXVIII.

If a plane AB, *be perpendicular to a plane* AC, *and a perpendicular line* EF *be drawn from a point* E *in one of the planes* (AB) *to the other plane* AC, *that perpendicular* EF *shall fall upon the common section of the planes* AD.

IF it be possible, let F fall without the intersection AD, and in the (a) 12. 1.
plane AC [a] draw FG perpendicular to AD, and join EG. The angle (b) 4. *and* 3 *def.* 11.
FGE [b] is a Right-angle, and EFG is supposed to be such also; therefore (c) 17. 1.
two Right-angles are in the triangle EFG. [c] *Which is Absurd.*

Prop

Prop. XXXIX.

If the sides (AE, FC, AF, EC, *and* DH, GB, DG, HB) *of the opposite planes* AC, DB, *of a solid Parallelepipedon* AB, *be divided into two equal parts, and planes,* ILQO, PKMR, *be drawn through their sections, the common section of the planes* ST, *and the diameter of the solid Parallelepipedon* AB *shall divide one the other into two equal parts.*

(a) 34. 1.
(b) 29. 1.
(c) 4. 1.
(d) sch. 15. 1.
(e) 34. 1.
(f) 9. 11. and 1. ax.
(g) 33. 1.
(h) 7. 11.
(k) 7 ax. 1.
(l) 26. 1.

DRaw the Right-lines *SA, SC, TD, TB*. Because [a] the sides *DO, OT* are equal to the sides *BQ, QT*, [b] and the alternate angles *TOD, TQB*, equal also, [c] the bases *DT, TB*, and the angles *DTO, BTQ* are equal; [d] therefore *DTB* is a Right-line; and so in like manner is *ASC*. Moreover [e] as well *AD* is parallel and equal to *FG* [e] as *FG* to *CB*, and [f] thence *AD* is parallel and equal to *CB*; [g] and consequently *AC* to *DB*; [h] wherefore *AB* and *ST* are in the same plane *ABCD*. Therefore since the vertical angles *AVS, BVT*, and the alternate angles *ASV, BTV* are equal; [k] and $AS = BT$; therefore shall AV be $= BV$, [l] and $SV = VT$. *W. W. to be Dem.*

Corol.

Hence in every Parallelepipedon all the diameters bisect one another in one point, *V*.

Prop. XL.

If two prisms ABCFED, GHMLIK, *be of equal altitude, whereof one hath its base* ABCF, *a Parallelogram, and the other* GHM *a triangle; and if the Parallelogram* ABCF, *be double to the triangle* GHM; *these prisms* ABCFED, GHMLIK *are equal.*

(a) 31. 11.
(b) 34. 1. and 7 ax.
(c) hyp.
(d) 28 11.
(e) 7. ax. 1.

FOr if the parallepps. *AN, GQ*, be compleated, [a] they shall be equal, because of the equality [b] of the bases *AC, GP*, and [c] of the altitudes; [d] therefore also the prisms, [e] the halfs thereof shall be equal. *W. W. to be Dem.*

Schol.

Andr. Tacq.

From the preceding demonstrations, the dimension of triangular prisms, and quadrangular, or parallelepipedons, is learnt; viz. *by multiplying the altitude into the base.*

As

As if the altitude be 10 foot, and the base 100 square foot (the base may be measured by *sch.* 35, 1. or by 41, 1.) then multiply 100 by 10, and 1000 cubic foot shall be produced for the solidity of the prism given.

For as a Rectangle, so also is a right Parallelepipedon produced of the altitude multiplied into the base. Therefore every Parallelepipedon is produced of the altitude multiplyed into the base, as appears by 31. of this Book.

Moreover, since the whole Parallelepipedon is produced of the altitude drawn in to the base, the half thereof (that is, a triangular prism) shall be produced of the altitude drawn into half the base, namely the triangle.

An Advertisement.

Obs. That of those letters which denote a solid angle, the first is always at the point in which the angle is; but of those letters which denote a pyramid, the last is at the supreme point thereof.

Ex. gr. The solid angle *ABCD* is at the point *A*, and the supreme point of the pyramid *BCDA* is at the point *A*, and the base is the triangle *BCD*.

THE

THE TVVELFTH BOOK OF Euclid's Elements.

PROPOSITION I.

***Like polygonous figures* ABCDE, FGHIK, *deſcribed in circles* ABD, FGI, *are one to another, as the ſquares deſcribed of the diameters of the circles* AL, FM.**

(a) 1 *def.* 6. (b) 6. 6. (c) 21. 3. (d) 31. 3. (e) 32. 3. (f) *cor.* 4. 6. (g) 22. 6.

DRaw AC, BL, FH, GM. Becauſe [a] the angle $ABC = FGH$, [a] and $AB . BC :: FG . GH$; [b] therefore ſhall the angle ACB ([c] ALB) be $= FHG$ ([c] FMG.) but the angles ABL, FGM [d] are right and ſo equal; [e] therefore the triangles ABL, FGM are equiangular; [f] wherefore $AB . FG :: AL . FM$; [g] therefore $ABCDE . FGHIK :: ALq . FMq$.

Corol.

Corol.

Hence (becauſe $AB . FG :: AL \quad FM :: BC . GH$, &c.) the contents of like polygonous figures deſcribed in a circle are in [h] proportion as the diameters. (h) 1. 12. and 12. 5.

Prop. II.

Circles ABT, EFN, *are in proportion one to another, as the ſquares of their diameters* AC, EG *are.*

SUppoſe $ACq . EGq ::$ the circle $ABT . I$. I ſay then I is equal to the circle EFN.

For firſt, if it be poſſible, let I be leſſe then the circle EFN, and let K be the exceſs or difference. Inſcribe the Square $EFGH$ in the circle EFN, [a] it being the half of a circumſcribed ſquare, and ſo greater than the ſemicircle. [b] Divide equally in two the arches EF, FG, GH, HE, and at the points of the diviſions join the Right-lines EL, LF, &c. at L draw the tangent PQ ([c] which is parallel to EF) and produce HEP, GFQ; than is the triangle ELF [d] the half of the Pgr. $EPQF$, and ſo greater then the half of the ſegment ELF; and in like ſort the reſt of thoſe triangles exceed the halfs of the reſt of the ſegments. And if the arches EL, LF, FM, &c. be again biſected, and the Right-lines joined, the triangles will likewiſe exceed the half of the ſegments. Wherefore if the ſquare $EFGH$ be taken from the circle EFN, and the triangles from the other ſegments, and this be done continually, at length [e] there will remain ſome magnitude leſs than K. Let us have gone ſo far, namely to the ſegments EL, LF, FM, &c. taken together leſs than K. Therefore I ([f] the circle $EFN - K$) $\sqsupset$ the polyg. $ELFMGNHO$ (the circle $EFN -$ the ſegm. $EL \quad LF$, &c.) In the circle ABT [g] conceive a like polygonon $AKBSCTDV$ inſcribed; therefore ſince $AKBSCTDV . ELFMGNHO$ [h] $:: ACq . EGq$ [k] $::$ the circle $ABT . I$; and the polyg. $AKBSCTDV$ [l] $\sqsupset$ the circle ABT. the polyg. $ELFMGNHO$ [m] ſhall be $\sqsupset I$; but before, I was $\sqsupset ELFMGNHO$, which is repugnant.

(a) *ſch.* 7. 4. (b) 30. 3. (c) *ſch.* 27. 3. (d) 41. 1. (e) 1. 10. (f) *hyp. and* 3 *ax.* (g) 30. 3. *and* 1. *poſt.* 1. (h) 1. 12. (k) *hyp.* (l) 9. *ax.* 1. (m) 14. 5.

Again, if it be poſſible, let I be $\sqsubset$ the circle EFN. Therefore becauſe $ACq . EGq$ [n] $:: ABT . I$; and inverſely I . the circle $ABT :: EGq . ACq$; ſuppoſe I . the circle $ABT ::$ the circle $EFN . K$; [o] therefore the circle $ABT \sqsubset K$; [p] and $EGq . ACq ::$ the circle $EFN . K$; which is ſhewn to be repugnant.

(n) *hyp.* (o) 14. 5. (p) 11. 5.

Therefore it muſt be concluded, that I is $=$ to the circle EFN. *W. W. to be Dem.*

Corol.

Coroll.

Hence it follows, that as a circle is to a circle, so is a polygonon described in one to a like polygonon described in the other.

Prop. III.

Every Pyramid ABDC *having a triangular base, may be divided into two pyramids* AEGH, HIKC, *equal, and like one to the other, having bases triangular, and like to the whole* ABDC; *and into two equal prisms,* BFGEIH, EGDIHK; *which two prisms are greater than the half of the whole pyramid* ABDC.

Divide the sides of the pyramid into two parts at the points *E, F, G, H, I, K*; and join the Right-lines *EF, FG, GE, EI, IF, FK, KG,*
(a) 2. 6. *GH, HE.* Because the sides of the pyramid are proportionally cut; [a] thence
HI, AB; and *GF, AB*; and *IF, DC*; and *HG, DC,* &c. are parallels; and consequently *HI, FG*; and *GH, FI* are also parallels. Therefore it is apparent that the triangles *ABD, AEG, EBF, FDG, HIK,*
(b) 29. 1. [b] are equiangular; and that the four last are [c] equal: in like manner the
(c) 26. 1. triangles *ACB, AHE, EIB, HIC, FGK* are equiangular; and the four last are equal one to the other. Also the triangles *BFI, FDK, IKC, EGH*; and lastly the triangles *AHG, GDK, HKC, EFI* are like and equal. Moreover the triangles, *HIK* to *ADB,* and *EGH* to *BCD,*
(d) 15. 11. and *EFI* to *ADC,* and *FGK* to *ABC,* [d] are parallel. From whence it evidently follows, first that the pyramids *AEGH, HIKC* are equal,
(e) 10. *def.* 11. and [e] like to the whole *ABDC,* and to one another. Next, that the solids *BFGEIH, FGDIHK* are prisms, and that of equal height, as being placed between the parallel planes *ABD, HIK*; but the base *BFGE* is
(f) 2 *ax.* 1. [f] double of the base *FDG.* [g] Wherefore the said prisms are equal; whereof
(g) 40. 11. the one *BFGEIH* is greater than the pyramid *BEFI,* that is, than *AEGH,* the whole than its part; and consequently the two prisms are greater than two pyramids, and so exceed the half of the whole pyramid *ABDC.* *W. W. to be Dem.*

Prop.

Prop. IV.

If there be two Pyramids ABCD, EFGH, *of the same altitude, having triangular bases* ABC, EFG; *and either of them be divided into two pyramids* (AILM, MNOD; *and* EPRS, STVH) *equal one to the other and like to the whole, and into two equal prisms* (IBKLMN, KLCNMO; *and* PFQRST, QRGTSV;) *and if in like manner either of those pyramids made by the former division be divided, and this be done continually; then as the base of one pyramid is to the base of the other pyramid, so are all the prisms which are in one pyramid, to all the prisms which are in the other pyramid, being equal in multitude.*

For (applying the construction of the precedent *Prop.*) *BC . KC* [a] :: (a) 15. 5.
FG . GQ; [b] therefore the triangle *ABC* is to the like triangle *LKC* (b) 22. 6.
as *EFG* is to [c] the like *RQG*; therefore by permutation *ABC . EFG* (c) 2. 6. &c.
[d] :: *LKC . RQG* [e] :: the prism *KLCNMO . QRGTSV* (for these (d) 16. 5.
are of equal altitude) [f] :: *IBKLMN . PFQRST*; [g] wherefore the (e) *sch.* 34. 11.
triang. *ABC . EFG* :: the prism *KLCMNO* $+$ *IBKLMN.* the (f) 7. 5.
prism *QRGTSV* $+$ *PFQRST.* *W. W. to be Dem.* (g) 12. 5.

But if the pyramids *MNOD, AILM*; and *EPRS, STVH*; be further divided, in like manner the four new prisms made hereby shall be to the four produced before, as the bases *MNO* and *ALI* are to the bases *STV* and *EPR*; that is, as *LKC* to *RQG,* or as *ABC* to *EFG*; [b] wherefore all the prisms of the pyramid *ABCD* are to all the prisms of the pyramid *EFGH,* as the base *ABC* is to the base *EFG.* *W. W. to be Dem.*

Prop. V.

Pyramids ABCD, EFGH, *being under the same altitude, having triangular bases* ABC, EFG, *are one to another as their bases* ABC, EFG, *are.*

Let the triangle *ABC . EFG* :: *ABCD . X.* I say *X* is equal to the pyramid *EFGH.* For if it be possible, let *X* be $\sqsupset$ *EFGH*; and let the excess be *Y.* Divide the pyramid *EFGH* into prisms and
pyramids, and the other pyramids in like manner, [a] till the pyramids left (a) 1. 10.
EPRS, STVH, be less than the solid *Y.* Therefore since the pyramid *EFGH* $=$ *X* $+$ *Y,* it is manifest that the remaining prisms *PFQRST, QRGTSV* are greater than the solid *X.* Conceive the pyramid *ABCD*
divided after the same manner; [b] then will be the prism *IBKLMN* $+$ (b) 4. 12.
KLCNMO, PFQRST $+$ *QRGTSV* :: *ABC . EFG* [c] :: the (c) *hyp.*
pyr. *ABCD . X*; [d] therefore *X* $\sqsubset$ the prism *PFQRST* $+$ *QRGTSV*; (d) 14. 5.
which is contrary to that which was affirmed before.

Again.

Again, conceive *X* ⊏ the pyr. *EFGH*; and make the pyr. *EFGH* . (e) hyp. and cor. 4. 5. *Y* :: *X* . the pyr. *ABCD* [e] :: *EFG* . *ABC*. Because *EFGH* [f] ⊐ (f) suppos. *X*, [g] thence *Y* ⊐ the pyr. *ABCD*; which is shewn before to be impossible. (g) 14. 5. Therefore I conclude, that *X* is equal to the pyr. *EFGH*. *W. W. to be Dem.*

Prop. VI.

Pyramids ABCDEF, GHIKLM, *consisting under the same altitude, and having polygonous bases* ABCDE, GHIKL, *are to one another as their bases* ABCDE, FGHIKL *are.*

Draw the Right-lines *AC*, *AD*, *GI*, *GK*; then is the base *ABC* . *ACD* [a] :: pyr. *ABCF* . *ACDF*; [b] therefore by composition, *ABCD* . *ACD* :: the pyr. *ABCDF* . *ACDF*; [a] but also *ACD* . *ADE* :: the pyr. *ACDF* . *ADEF*; [c] therefore of equality *ABCD* . *ADE* :: *ABCDF* . *ADEF*; and [b] thence by composition *ABCDE* . *ADE* :: the pyr. *ABCDEF* . *ADEF*; moreover *ADE* . *GKL* [d] :: the pyr. *ADEF* . *GKLM*; and, as before, and inversly *GKL* . *GHIKL* :: the pyr. *GKLM* . *GHIKLM*; [c] therefore again of equality *ABCDE* . *GHIKL* :: the pyr. *ABCDEF* . *GHIKLM*. *W. W. to be Dem.*

(a) 5. 12.
(b) 18. 5.
(c) 22. 5.
(d) 5. 12.

If the bases have not sides of equal multitude, the demonstration will proceed thus. The base *ABC* . *GHI* :: [e] the pyr. *ABCF* . *GHIK*; [c] and *ACD* . *GHI* :: the pyr. *ACDF* . *GHIK*; [f] therefore the base *ABCD* . *GHI* :: the pyr. *ABCDF* . *GHIK*. [e] Moreover the base *ADE* . *GHI* :: the pyr. *ADEF* . *GHIK*; [f] therefore the base *ABCDE* . *GHI* :: the pyr. *ABCDEF* . *GHIK*.

(e) 5. 12.
(f) 24. 5.

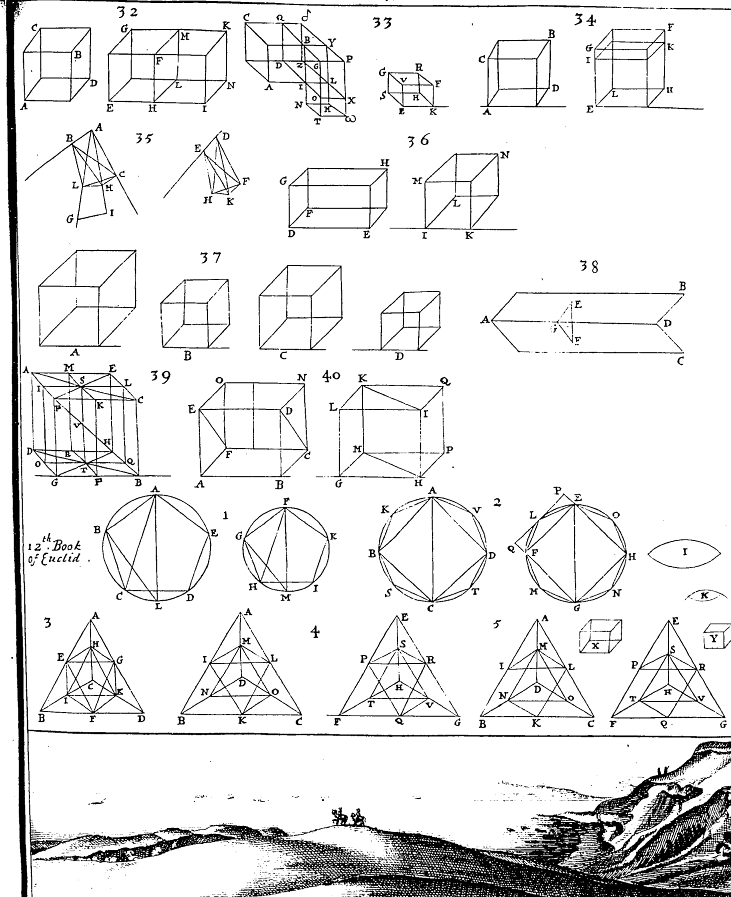
Prop. VII.

Every prism, ABCDEF, *having a triangular base, may be divided into three pyramids* ACBF, ACDF, CDFE, *equal one to the other, and having triangular bases.*

Draw the diameters of the Parallelograms, *AC*, *CF*, *FD*. Then the triangle *ACB* is [a] = *ACD*; [b] therefore the pyramids of equal height *ACBF*, *ACDF*, are equal. In like manner the pyr. *DFAC* = the pyr. *DFEC*; but *ACDF* and *DFAC* are one and the same pyramid; [c] therefore the three pyramids *ACBF*, *ACDF*, *DFEC*, into which the prism is divided, are equal one to the other. *W. W. to be Dem.*

(a) 34. 1.
(b) 5. 12.
(c) 1 ax. 1.

Hence, every pyramid is the third part of the prism that has the same base and height with it; or every prism is treble of that pyramid that has the same base and height with it.



For resolve the pologonous prism *ABCDEGHIKF* into triangular prisms; and the pyramid *ABCDEH* into triangular pyramids; [a] then all the parts of the prism shall be treble to all the parts of the pyramid, [b] consequently the whole prism *ABCDEGHIKF* is treble to the whole pyramid *ABCDEH*. *W. W. to be Dem.*

(a) 7. 12.
(b) 1. 5.

Prop. VIII.

Like pyramids ABCD, EFGH, *which have triangular bases* ABC, EFG, *are in triple proportion of that in which their sides of like proportion* AC, EG *are.*

[a] COmpleat the Parallelepipedons *ABICDMKL*, *EFNGHQOP*, which [b] are like, and [c] sextuple of the pyramids *ABCD*, *EFGH*; [d] and therefore in the same proportion with them one to another, [e] that is, triple of that of the sides of like proportion, &c.

(a) 27. 11.
(b) 9 *def.* 11.
(c) 28. 11. *and* 7. 12.
(d) 15. 5.
(e) 33. 11.

Corol.

Hence also, like polygonous pyramids have proportion tripled to that of the sides of like proportion; as may easily be proved by resolving the same into triangular pyramids.

Prop. IX.

See the prec. Scheme.

In equal pyramids ABCD, EFGH, *having triangular bases* ABC, EFG, *the bases and altitudes are reciprocal; And pyramids having triangular bases, whose altitudes and bases are reciprocal, are equal.*

1. *Hyp.* THe compleated Parallelepipedons *ABICDMKL*, *EFNGHQOP* are [a] sextuple of the equal pyramids *ABCD*, *EFGH* (either of either) and so equal one to the other. Therefore the altitude (*H.*) the alt. (*D*) [b] :: *ABIC* . *EFNG* [c] :: *ABC* . *EFG*. *W. W. to be Dem.*

2. *Hyp.* The altitude (*H.*) the alt. (*D*) [d] :: *ABC* . *EFG* [e] :: *ABIC* . *EFNG*; [f] therefore the parallelepipedons *ABICDMKL*, *EFNGHQOP* are equal; [g] consequently also the pyramids *ABCD*, *EFGH*, being subsextuple of the same, are equal. *W. W. to be Dem.*

(a) 28. 11. *and* 7. 12.
(b) 34. 11.
(c) 15. 5.
(d) *hyp.*
(e) 15. 5.
(f) 34. 11.
(g) 6 *ax.* 1.

The same is applicable to polygonous pyramids; for they may also in like manner be reduced to triangulars.

Corol.

Corol.

Whatsoever is demonstrated of pyramids in Prop. 6, 8, 9. *do's likewise agree to any sort of prisms; seeing they are triple of the pyramids that have the same base and altitude with them.* Therefore,

1. The proportion of prisms of equal altitude is the same with that of their bases.

2. The proportion of like prisms is triple of that of the sides of like proportion.

3. Equal prisms have their bases and altitudes reciprocal; and prisms which are so reciprocal, are equal.

Schol.

From what is hitherto demonstrated the dimension of any prisms and pyramids may be collected.

(a) 1. *cor.* 12. *and sch.* 40. 11. (b) 7. 12. [a] The solidity of a prism is produced of the altitude multiplyed into the base; [b] and therefore likewise that of a pyramid, of the third part of the altitude multiplied into the base.

Prop. X.

Every Cone is the third part of a Cylinder having the same base with it ABCD, *and the altitude equal.*

See the second fig. of this Book. IF you deny it, then first let such cylinder be more then triple to the cone, and let the excess be E. A prism described on a square in the circle
(a) *sch.* 7. 4. *and cor.* 9. 12. $ABCD$ [a] is subduple of a prism described upon a square about the circle, being equal to it and the cylinder in height. Therefore a prism upon the square $ABCD$ exceeds the half of the cylinder; and likewise a prism
(b) *sch.* 27. 3. *and cor.* 9. 12. upon the base AFB, of equal height to the cylinder, [b] is greater than the half of the segment of the cylinder AFB; continue an equal bisection of the arches, and subtract the prisms till the remaining segments of the cylinder, namely at AF, FB, &c. become less than the solid E. Therefore the cyl.
(c) 5 *ax.* 1. — segm. AF, FB, &c. (the prism on the base $AFBGCHDI$) [c] is greater
(d) *hyp.* than the cylinder — E ([d] the triple of the cone;) therefore the pyramid,
(e) *cor.* 7. 12. [e] a third part of the said prism (being placed on the same base, and of the same height) is greater than the cone of equal height on the base $ABCD$ a circle, *i. e.* the part greater than the whole. *Which is Absurd.*

But

But if the cone be affirmed to be greater than the third part of the cylinder, then let the excess be E. Detract the pyramids from the cone, as you did in the first part the prisms from the cylinder, till some segments of the cone remain, conceive at AF, FB, BG, &c. less than the solid E. Therefore the cone — E ([f] $\frac{1}{3}$ of the cylin.) $\sqsupset$ the pyr. $AFBGCHDI$ (f) *hyp.*
(the cone — segm. AF, FB, &c.) therefore the prism triple to the pyramid (*viz.* of equal height, and on the same base) is greater than the cylinder on the base $ABCD$, the part than the whole. *Which is Abs.* Wherefore it must be granted, that the cylinder is equal to triple of the cone. *W. W. to be Dem.*

Prop. XI.

Cylinders and Cones ABCDK, EFGHM, *being under the same altitude, are to one another as their bases* ABCD, EFGH, *are.*

LEt the circle $ABCD$. the cir. $EFGH$ :: the cone $ABCDK$. N. I say N is equal to the cone $EFGHM$.

For if it be possible, let N be $\sqsupset$ the cone $EFGHM$, and let the excess be O. The preparation and argumentation of the prec. *Prop.* being supposed; then shall O be greater than the segments of the cone EP, PF, FQ, &c. and so the solid N $\sqsupset$ the pyr. $EPFQGRHSM$. In the circle $ABCD$ [a] make a like polygonous fig. $ATBVCXDY$. Because (a) 20. 3. *and* 1 *post.*
the pyr. $ABVYK$. the pyr. $EFQSM$ [b] :: the polyg. $ATBVY$. (b) 6. 12.
the polyg. $EPFQS$ [c] :: the cir. $ABCD$. the cir. $EFGH$ [d] :: the cone (c) *cor.* 2. 12.
$ABCDK$. N [e] thence the pyr. $EPFQGRHSM$ shall be $\sqsupset$ N. (d) *hyp.*
Contrary to what was affirmed before. Again conceive N $\sqsubset$ the cone (e) 14. 5.
$EFGHM$; and make the cone $EFGHM$. O :: N . the cone ABC (f) *hyp. and by*
DK [f] :: the circ. $EFGH$. $ABCD$; [g] therefore O $\sqsupset$ the cone ABC *inversion.*
DK; *Which is Absurd,* as appears by what is shewn in the first part. (g) 14. 5.

Therefore rather admit $ABCD$. $EFGH$ :: the cone $ABCDK$. $EFGHM$. *W. W. to be Dem.*

The same may be demonstrated of cylinders, if cylinders and prisms be conceived in the place of cones and pyramids. Therefore, *&c.*

Schol.

Hence, is gathered the dimension of all sorts of cylinders and cones. The solidity of a Right cylinder is produced of the circular base ([a] the dimension whereof (a) 1. Prop. *de dimens. circ.*
is to be learnt out of *Archimedes*) multiplied into the height, [b] whence (b) 11. 12.
in like manner that of every cylind.

Therefore the solidity of a cone is produced of the third part of the altitude multiplied in the base.

Prop.

Prop. XXII.

Like Cones and Cylinders ABCDK, EFGHM, *are in triple proportion of that of the diameters* TX, PR, *of their bases* ABCD, EFGH.

LEt the cone A have to N triple proportion of TX to PR. I say N is = the cone EFGHM. For if it be possible let N be ⊐ the cone EFGHM; and let the excess be O; therefore, N ⊐ the pyr. EPFQG RHSM. Let the axes of the cones be IK, LM, and joyn the Right-lines VK, CK, VI, CI, and QM, GM, QL, GL. Because the cones are
(a) 14 *def.* 11. like, [a] thence VI . IK :: QL . LM; but the angles VIK, QLM
(b) 18 *def.* 11. [b] are Right-angles; [c] therefore the triangles VIK, QLM are equiangul.
(c) 6. 6. [d] whence VC . VI :: QG . QL; also VI . VK :: QL . QM;
(d) 4. 6. therefore of equality VC . VK :: QG . QM; [e] moreover VK . CK
(e) 7. 5. :: QM . MG. Therefore again of equality VC . CK :: QG . GM;
(f) 5. 6. [f] therefore the triangles VKC, QMG are like: and by the same reason
(g) 9 *def.* 11. the other triangles of this pyramid are like to the other of that; [g] wherefore
(h) *cor.* 8. 12. the pyramids themselves are like. [h] But they are in triple proportion of
(k) 4. 6. that of VC to QG; [k] that is, of VI to RL; [l] or TX to PR; [m] there-
(l) 15. 5. fore the pyr. AIRVCXDYK . the pyr. EPFQGRHSM :: the
(m) *hyp.* and 11. 5. cone ABCDK . N; [n] whence the pyr. EPFQGRHSM ⊐ N, which
(n) 14. 5. is repugnant to what was affirmed before.

Again, take N ⊏ the cone EFGHM; make the cone EFGHM .
(o) *before and inversly.* O :: N . the cone ABCDK [o] :: the pyr. EPRM . ATCK [p] :: GQ
(p) *cor.* 8. 12. . VC thrice :: [q] PR · TX thrice; but O [r] is ⊐ ABCDK; which was
(q) 4. 6. before shewn to be repugnant. Wherefore N = the cone EFGHM.
(r) 14. 5. *W. W. to be Dem.*

But forasmuch as what proportion soever cones have, also cylinders, being triple of them, have the same; therefore cylinder to cylinder shall have proportion triple of the diameters of the bases.

Prop. XIII.

If a Cylinder ABCD, *be divided by a plane* EF *parallel to the opposite planes* BC, AD, *then as one Cylinder* AEFD *is to the other Cylinder* EBCF, *so is the axis* GI *to the axis* IH.

(a) 3. 1. THe axis being produced, [a] take GK = GI, and HL = IH = LM; and conceive planes drawn at the points K, L, M, parallel to the
(b) 11. 12. circles AD, BC, [b] therefore the cylinder FD = the cyl. AN; and the cyl. EC [b] = BO [b] = OP; therefore the cylinder EN is as multiplex of the cylinder ED, as the axis IK is of the axis IG; and in like manner the cylinder FP is as multiplex of the cylinder BF, as the axis IM is of the axis
(c) 11. 12. IH; but as IK is =, ⊏, ⊐ IM, [c] so is the cylinder EN =, ⊏, ⊐ FP;
(d) 6 *def.* 5. [d] therefore the cylinder AEFD . the cyl. EBCF :: GI . IH. *W. W. to be Dem.*

Prop.

Prop. XIV.

Cones AEB, CFD, *and Cylinders* AH, CK, *consisting upon equal bases* AB, CD, *are to one another as their altitudes* ME, NF *are.*

THe cylinder HA, and the axis EM being produced, take ML = FN; and at the point L draw a plane parallel to the base AB, [a] then (a) 11. 12.
shall the cyl. AP be = CK; [b] but the cyl. AH . AP (CK) :: ME . (b) 13. 12.
ML (NE.) *W W to be Dem.*

The same may be affirmed of cones subtriple of cylinders; * as also of prisms, * *apply* 9. and 7. 12.
and pyramids.

Prop. XV.

In equal cones BAC, EDF, *and Cylinders* BH, EK, *the bases and altitudes are reciprocal* (BC . EF :: MD . LA:) *And cones and cylinders, whose bases and altitudes are reciprocal, are equal one to the other.* (a) 14. 12.
(b) *constr.*

IF the altitudes be equal then the bases are equal too, and the thing is evident. If unequal, then take away MO = LA. (c) *hyp.*
(d) 11 12.
(e) *hyp.*

1. *Hyp.* Then is MD . MO ([a] LA) [b] :: cyl. EK . ([c] BH) EQ (f) 11. 12.
[d] :: the cir. BC . EF. *Which was to be Dem.* (g) 11. 5.

2. *Hyp.* BC . EF [e] :: DM . OM (LA) [f] :: the cyl. EK . EQ [g] :: (h) 11. 12.
BC . EF [h] :: BH . EQ. [k] Therefore the cylind. EK = BH. *Which was to be Dem.* (k) 9. 5.

The same argument may be used for cones.

Prop. XVI.

Two unequal circles ABCG, DEF, *having the same center* M, *to inscribe in the greater circle* ABCG, *a polygonous figure of equal and even sides, which shall not touch the lesser circle* DEF.

THrough the center M draw the line AC, cutting the circle DEF in F, from whence raise a perpendicular FH; [a] divide the semicircle ABC (a) 30. 3.
into two equal parts; and the half thereof BC also; and so do continually, [b] till the arch IC become less then the arch HC, from I let fall the perpendicular (b) 1. 10.
IL. It is manifest that the arch IC measures the whole circle, and that the (c) *sch.* 16. 4.
number of arches is even, and so that the subtended line IC is the side [c] of the polygonon that may be inscribed without touching the lesser circle DEF.
For HG [d] touches the circle DEF, [e] to which IK is parallel, and placed (d) *cor.* 16. 3.
(e) 28. 1.
outwardly; [f] wherefore IK does not touch the circle DEF; much less do (f) 34. *def.* 1
CI, CK, and the other sides of the polygonon more remote from the center. *W. W. to be Done.*

Corol. Observe that IK touches not the circle DEF.

Prop.

Prop. XVII.

Two spheres ABCV, EFGH, *consisting about the same center* D, *being given, to inscribe a solid of many sides (or Polyedron) in the greater sphere* ABCV, *which shall not touch the superficies of the lesser sphere* EFGH.

LEt both the spheres be cut by a plane passing by the center making the
circles $EFGH$, $ABCV$; and the diameters AC, BV drawn,
(a) 16. 12. cutting perpendicularly. In the circle $ABCV$, [a] inscribe the equilateral
polygon $VMLNC$, &c. not touching the circle $EFGH$: then draw the
diameter $N\alpha$, and erect DO perpendicular to the plane ABC; by DO,
and by the diameters AC, $N\alpha$, conceive planes DOC, DON erected,
(b) 18. 11. which shall be [b] perpendicular to the circle $ABCV$, and so in the superficies
(c) cor 33. 6. of the sphere make [c] the quadrants DOC, DON. In which let the right
(d) 4. 1. lines CP, PQ, QR, RO, NS, ST, $T\gamma$, γO; [d] be fitted, equal, and
of equal multitude with CN, NL, &c. make the same construction in the
other quadrants OL, OM, &c. and in the whole sphere. Then I say the
thing required is done.

From the points P, S, to the plane $ABCV$ draw the perpendiculars
(e) 38. 11. PX, SY, [e] which shall fall on the sections AC, $N\alpha$. Therefore because
(f) 12. ax. both [f] the Right-angles PXC, SYN, [g] and PCX, SNY insisting on [h] equal
(g) 27. 3. circumferences, [f] are equal, the triangles also PCX, SNY [h] are equiangu-
(h) 32. 1. (k) constr. lar. Wherefore being PC [k] $= SN$, [l] also is $PX = SY$, [l] and $KC = YN$;
(l) 26. 1. [m] whence $DX = DY$; [n] and therefore $DX . XC :: DY . YN$; [o] there-
(m) 3 ax. 1. fore YX, NC are parallels; but because PX, SY are equal, and since be-
(n) 7. 5. ing perpendicular to the same plane $ABCV$, they are also [p] parallels,
(o) 2. 6. (p) 6. 11. [q] therefore YX, SP shall be equal and parallels; [r] whence SP, NC, are
(q) 33. 1. parallel one to the other; and so the [s] quadrilateral $NCPS$, and by the
(r) 9. 12. same reason $SPQT$, $TQRG$, as also the [t] triangle γRO are so many
(s) 7. 11. planes. In like manner the whole sphere may be shewn full of such quadri-
(t) 2. 11. laterals and triangles; wherefore the figure inscribed is a polyedron.

(u) 11. 11. From the center D [u] draw DZ, perpendicular to the plane $NCPS$; and
(x) 4. 6. join ZN, ZC, ZS, ZP. Because $DN . NC$ [x] $:: DY . YX$, thence
(y) 14. 5. NC is [y] $\sqsubset YX$ (SP,) and likewise $SP \sqsubset TQ$, and $TQ \sqsubset \gamma R$. And
(z) 3 def. 11. because the angles DZC, DZN, DZS, DZP, [z] are right, and the sides
(a) 15 def. 11. (b) 47. 1. DC, DN, DS, DP, [a] equal, and DZ common, [b] thence ZC, ZN,
(c) 15 def 1. ZS, ZP, are equal one to the other; and consequently about the quadri-
(d) constr. lateral $NCPS$, [c] a circle may be described, in which (because NS, NC,
(e) 28. 3. CP, are [d] equal, and $NC \sqsubset SP$) NC [e] subtends more then the quadrant,
(f) 33. 9. [f] therefore the ang. NZC at the center is obtuse. [g] Therefore $NCq \sqsubset 2$
(g) 12. 2. (h) 32. 1. Zq ($ZCq + ZNq$.) Let NI be drawn perpendicular to AC; there-
(k) 9 ax. 1. fore since the angle ADN ([h] $DNC + DCN$) [k] is obtuse, the half of it
(l) 5. 1. DCN, shall be greater then the half of a right angle; [l] and so that which
remains

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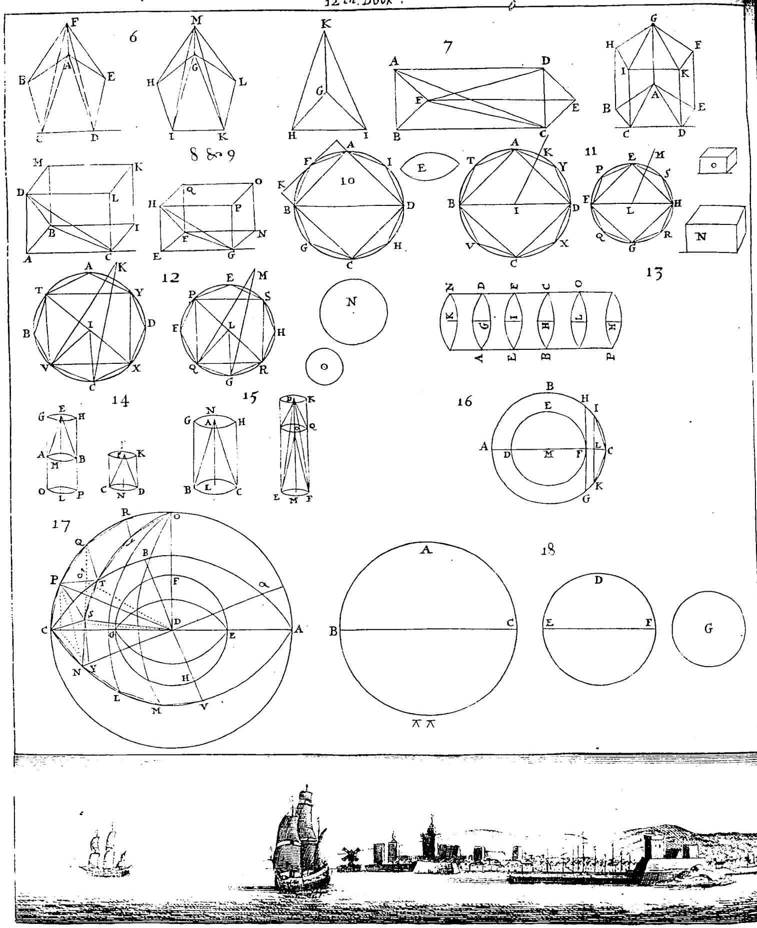

Eucl: Page 146.

remains of the right ang. CNI shall be less then it; [n]whence $IN \sqsubset IC$; there- (n) 19. 1.
fore NCq $(NIq + ICq)$ [o] $\sqsupset 2\,INq$; therefore $IN \sqsubset ZC$, and con- (o) 47. 1.
sequently DZ [p] $\sqsubset DI$, but the point I is [q] without the sphere $EFGH$, and (p) 47. 1. (q) *cor.* 19. 12.
so much more the point Z. Wherefore the plane $NCPS$, (whose [r] next (r) 47. 1.
point to the center is Z) does not touch the sphere $EFGH$. And if a perpendicular $D\delta$ be drawn to the plane $SPQT$, the point δ, and so also the plane $SPQT$ is yet further removed from the center; which is also true of the other planes of the polyedron. Therefore the polyedron $ORQPC\aleph$, &c. inscribed in the greater sphere, does not touch the lesser. *W.W. to be Done.*

Corol.

Hence it follows, *that if in any other sphere a solid polyedron, like to the abovesaid solid polyedron be inscribed, the proportion of the polyedron in one sphere to the polyedron in the other is triple of that of the diameters of the spheres.*

For if right-lines be drawn from the centers of the spheres to all the angles of the bases of the said polyedrons, then the polyedrons will be divided into pyramids equal in number and like: whose homologous sides are semidiameters of the spheres, as appears, if the lesser of these Spheres be conceived described within the greater about the same center. For the right-lines drawn from the center of the sphere to the angles of the bases will agree one to the other by reason of the likeness of the bases; and so will like pyramids be made. Wherefore since every pyramid in one sphere, to every pyramid like it in the other
sphere [a] has proportion triple to that of the homologous sides, that is, of the (a) *cor.* 8. 12.
semidiameters of the spheres; and [b] as one pyramid is to one pyramid, so all (b) 12. 5.
the pyramids, that is, the solid polyedron composed of these, are to all the pyramids, that is, the solid polyedron composed of the others; therefore the polyedron of one sphere shall have to the polyedron of the other sphere, pro-
portion triple of that of the semidiameters, [c] and so of the diameters of the (c) 15. 5.
spheres.

Prop. XVIII.

Spheres BAC, EDF, *are in triple proportion one to the other of that in which their diameters* BC, EF, *are.*

Let the sphere BAC be to the sphere G in triple proportion of that of the diameter BC to the diameter EF, I say $G = EDF$. For if it be possible, let G be $\sqsupset EDF$; and conceive the sphere G concentrical with EDF. In
the sphere EDF [a] inscribe a polyedron not touching the sphere G, and a like (a) 17. 12.
polyedron in the sphere BAC. These polyedrons [b] are in triple proportion of (b) *cor.* 17. 12.
the diameters BC, EF, [c] that is, of the sphere BAC to G. [d] Consequently (c) *hyp.* (d) 14. 5.
the sphere G is greater then the polyedron inscribed in the sphere EDF, the part then the whole.

Again, if it be possible, let the sphere G be $\sqsubset EDF$, and as the sphere EDF
is to another sphere H, so let G be to BAC, [e] that is, in triple proportion of the (e) *hyp. invers.*
diameter EF to BC, therefore since BAC [f] $\sqsubset H$, we shall incur the absurdity (f) 14. 5.
of the first part, wherefore rather the sphere $G = EDF$. *W.W to be Dem.*

Corol. Hence, As one sphere is to another sphere, so is a polyedron described in that to a like polyedron described in this.

THE DOCTRINE OF SURDS.

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THE DOCTRINE OF SURDS.

CHAP. I.

REDUCTION.

SECT. I.

To reduce a Rational quantity to the forme of a Surd, which shall have the same Radical sign with any Surd prescribed.

INvolve (or multiply it *per se*) as often as there are Units in the Index of the assigned power, and prefix it's sign.

The

The Operation in Species.

Reduce b to the ſame ſign with $\surd(3)\,n^2$.

$\surd(3)\,b^3$.

Reduce $b-d$ to $\surd(2)\,\overline{b^2-d}$.

$$\begin{array}{r} b-d \\ \underline{b-d} \\ -bd+d^2 \\ b^2-bd \\ \hline \surd(2)\,\overline{b^2-2bd+d^2} \end{array}$$

Reduce the Numerator of this Fraction $\frac{a}{\surd b}$ to the ſign $\surd b$ the Denominator.

$$\begin{array}{r} a \\ \underline{a} \\ \surd\,a^2 \end{array}$$

Reduce the Denominator $(5d)$ of this Fraction $\frac{\surd(3)\,ac}{5d}$ to the ſign $\surd(3)\,ac$ the Numerator.

$$\begin{array}{r} 5d \\ \underline{5d} \\ 25d^2 \\ \underline{5d} \\ \surd(3)\,125d^3 \end{array}$$

The Operation in Numbers.

Reduce 6 to the ſign $\surd(3)\,12$.

$$\begin{array}{r} 6 \\ \underline{6} \\ 36 \\ \underline{6} \\ \surd(3)\,216 \end{array}$$

Reduce 5 to the ſign $\surd\,7$.

$$\begin{array}{r} 5 \\ \underline{5} \\ \surd\,25 \end{array}$$

Reduce the Numerator 3 of this Fraction $\frac{3}{\surd 7}$ to the ſign $\surd\,7$.

$$\begin{array}{r} 3 \\ \underline{3} \\ \surd\,9 \end{array}$$

Reduce the Denominator 7 of this Fraction $\frac{\surd(3)\,4}{7}$ to the ſign $\surd(3)\,4$ the Numearator.

$$\begin{array}{r} 7 \\ \underline{7} \\ 49 \\ \underline{7} \\ \surd(3)\,343 \end{array}$$

SECT. II.

To reduce ſimple heterogeneal Surds, that is, ſuch as are under different radical ſines to homogeneals, or to ſuch as may have a common radical ſine.

DIvide the Indices of the propoſed powers by their greateſt common meaſure, multiplying the ſaid Indices by each others quotients croſs-wiſe, and before the Product ſet $\surd$ with its Index for the common radical ſine; then multiply the powers themſelves alternately into the Species denominated by each others quotient.

Reduce $\surd\,a^2$ and $\surd(4)\,b^2$.

$$\begin{array}{ccc} 2)\,\surd\,a^2 & & \surd(4)\,b^2 \\ 1 & \times & 2 \\ \surd(4)\,b^2 & & \surd(4)\,a^4 \end{array}$$

Reduce $\surd\,5$ and $\surd(4)\,7$.

$$\begin{array}{ccc} 1)\,\surd\,5 & & \surd(4)\,7 \\ 2 & \times & 4 \\ \surd(8)\,49 & & \surd(8)\,625 \end{array}$$

SECT. III.

To reduce a Surd to another more Simple when it may be done.

WHen the power of a Surd quantity, the radical ſign being omitted, can be divided juſt without any remainder, by a power which hath a rational Root of the ſame kind with that which is denoted by the ſaid radical ſign; divide the Surd quantity propoſed by that rational Root, and prefix this Root before the Quotient; ſo have you a new Surd equal to the propoſed, and in more ſimple terms.

But when a Square or Cube &c. by which the diviſion neceſſary to ſuch contraction is to be performed, cannot be readily diſcerned, firſt ſearch out all the Diviſors of the power of the Surd quantity propoſed, and then ſee whether any of them be a Square or Cube &c. *viz.* ſuch a power as the radical ſign denotes, which if you find, you may uſe in the aforeſaid manner, to free the Surd quantity in part from the radical ſine.

$\surd\,48a^2$ will be reduced to $a\surd\,48$ or $2a\surd\,12$, or $4a\surd\,3$.

$\surd\,16aab$ may be reduced to $4a\surd\,b$.

$\surd(3)\,cb^3r$ will become $b\,\surd(3)\,cr$.

$\frac{\surd\,16a^2b}{c}$ will become $\frac{4a}{c}\surd\,b$.

$\surd\,72$ may be reduced to $6\surd\,2$.

$\surd\,75$ may be reduced to $5\surd\,3$.

$\surd(3)\,72$ will become $2\,\surd(3)\,9$.

$\frac{\surd\,75}{2}$ will become $\frac{5}{2}\surd\,3$.

SECT. IV.

Of the Commensurability of Surds.

COmmensurable Surds are such as being reduced to their least terms, become true figurative quantities of their kind; and are therefore as a rational quantity to a rational.

SECT. V.

To try whether any Quantities proposed be commensurable or not.

FIrst, if they be of different kinds, reduce them to one kind; then divide them severally by their greatest common measure, and if the quotients be rational quantities, the Surds proposed are commensurable; but if the quotients be irrational they are incommensurable.

If two Surd quantities be divided by some commmon divisor, tho it be not the greatest, yet if there come forth rational quotients, those Surds are commensurable.

If Surd Fractions be proposed that have not a common denominator, reduce them to their smallest common denominator, and then try whether the new Surd numerators be commensurable or not, for if those be commensurable, the Surd Fractions first proposed are commensurable.

But if either the numerators or denominators of two Surd Fractions, or mixt numbers standing Fraction wise (the radical sign being neglected) be powers of that kind which is denoted by the radical sign, then they need no reduction, but try whether their numerators or denominators be commensurable or not; for if these be commensurable, the Surd Fraction proposed shall be also commensurable, as $\sqrt{\frac{50}{16}}$ and $\sqrt{\frac{72}{25}}$.

CHAP.

CHAP. II.

Multiplication of Simple Surds.

1. IF the quantities to be multiplied be of the same kind, multiply them one by the other; and to the product præfix the common radical sign. But if they be heterogenial or of different kinds, reduce them first to one kind, and then multiply them.

Mult. by	$\sqrt{240}$ $\sqrt{15}$	$\sqrt{15}$ $\sqrt{26}$	$\sqrt{32}$ $\sqrt{48}$	$\sqrt{(3)}\,7\frac{2}{3}$ $\sqrt{(3)}\,\frac{3}{4}$	$\sqrt{(4)}\,15$ $\sqrt{(4)}\,7$
Product	$\sqrt{3600}$	$\sqrt{390}$	$\sqrt{1536}$	$\sqrt{(3)}\,5\frac{3}{4}$	$\sqrt{(4)}\,105$
Mult. by	$\left.\begin{matrix}\sqrt{8}\\ \sqrt{(3)}\,4\end{matrix}\right\}$ that is	$\left\{\begin{matrix}\sqrt{(6)}\,512\\ \sqrt{(6)}\,16\end{matrix}\right.$		$\sqrt{9}$ $\sqrt{(3)}\,27$	$\sqrt{(3)}\,32$ 2
Product		$\sqrt{(6)}\,8192$		$\sqrt{(6)}\,531441$	$\sqrt{(3)}\,256$

2. When a Surd is to be multiplied by a rational quantity, it will be sometimes convenient only to connex them together, or prefix the rational quantity to the left hand of the Surd. As to multiply $\sqrt{27}$ by 6 the product will be $6\sqrt{27}$, so 12 multiplied by $\sqrt{(3)}\,5$, the product will be $12\sqrt{(3)}\,5$ &c.

3. When two rational quantities are thus prefixt to two Surds of the same kind, multiply the rational part by the rational, and the Surd by the Surd, which products joined together, is the product required. As to multiply $6\sqrt{(3)}\,7$ by $5\sqrt{(3)}\,3$ the product will be $30\sqrt{(3)}\,21$, and $\sqrt{(4)}\,6$ multiplied by $3\sqrt{(4)}\,7$ will make $3\sqrt{(4)}\,42$; $5\sqrt{2}$ multiplied by $4\sqrt{5}$ makes $20\sqrt{10}$.

4. When any Surd is to be multiplied in it self according to the index of its own power, cast away the radical sign, and take the quantity remaining for the product, which in this case will be always rational. As the Square of $\sqrt{11}$ will be 11, the Cube of $\sqrt{(3)}\,17$, will be 17. Also $2\sqrt{3}$ multiplied by $8\sqrt{3}$ makes 48, and $3\sqrt{5}$ multiplied by $2\sqrt{5}$ makes 30 &c.

V 2 5. If

5. If a Surd whose index is a Compound number, be to be multiplied in it ſelf according to the index of either of the compounding Species; the root of the other Species ſhall only be prefixt to the ſpecial quantity.

As to Square $\sqrt{(4)}\ 12$, the product will be $\sqrt{}\ 12$, ſo the Square of $\sqrt{(6)}\ 15$ will be $\sqrt{(3)}\ 15$, the biquadrat of $\sqrt{}\ 5$ will be 25, the Cube of $\sqrt{(6)}\ 64$, will be $\sqrt{}\ 64$ or 8 &c.

CHAP.

CHAP. III.

Diviſion of Simple Surds.

1. IF the Surds be of the ſame kind divide one by the other, and to the quotient prefix the common radical ſign, which new root is the quotient ſought, but if they be not of the ſame kind firſt reduce them, and then divide.

Divide by	$\sqrt{}\ 576$ $\sqrt{}\ 9$	$\sqrt{}\ 256$ $\sqrt{}\ 8$	$\sqrt{(4)}\ 35$ $\sqrt{(4)}\ 5$	9 $\sqrt{(3)}\ 21$
Quot.	$\sqrt{}\ 64$ or 8	$\sqrt{}\ 32$	$\sqrt{(4)}\ 7$	$\sqrt{(3)}\ \frac{722}{21}$ or $\sqrt{(3)}\ 34\frac{2}{9}$
Divide by	$\sqrt{}\ b$ $\sqrt{}\ a$	$\sqrt{}\ abdg$ $\sqrt{}\ ab$	$\sqrt{}\ bl$ l	
Quot.	$\sqrt{}\ \frac{b}{a}$	$\sqrt{}\ dg$	$\sqrt{}\ \frac{b}{l}$	

2. When a rational quantity is to be divided by its Square Root, the Root will be the quotient. As ab, divided by $\sqrt{}\ ab$ the quotient will be $\sqrt{}\ ab$, and 50 divided by $\sqrt{}\ 50$ the quotient will be $\sqrt{}\ 50$, &c.

3. When a Surd with a prefixt rational quantity is to be divided by the ſame Surd, the quotient will be the ſaid prefixt rational quantity. As $5\sqrt{}\ 7$ divided by $\sqrt{}\ 7$ gives 5 for the quotient, or $5\sqrt{}\ 7$ divided by 5 will give $\sqrt{}\ 7$ in the quotient, &c

4. When the Dividend and Diviſor, are two rational quantities prefixed ſeverally to one common Surd; divide the rational part of the Dividend by the rational part of the Diviſor, and the quotient ſought is produced thereby. As $8\sqrt{}\ 5$ divided by $2\sqrt{}\ 5$ the quotient will be 4: alſo $8\sqrt{(3)}\ 7$ divided by $4\sqrt{(3)}\ 7$ gives 2 in the quotient.

5. When

5. When the Dividend and Divisor are two rational quantities prefixt to two unequal Surds, divide the rational part of the Dividend by the rational part of the Divisor, and the Surd part by the Surd part, which two quotients connexed together make the quotient desired. As $4\sqrt{13}$ divided by $2\sqrt{26}$, the quotient will be $2\sqrt{\frac{13}{26}}$ or $2\sqrt{\frac{1}{2}}$. So $4\sqrt{30}$ divided by $2\sqrt{10}$ the quotient will be $2\sqrt{3}$. Also $5\sqrt{(3)}\,20$ divided by $3\sqrt{(3)}\,4$ the quotient will be $\frac{5}{3}\sqrt{(3)}\,5$, and $5\sqrt{8}$ divided by $\sqrt{8}$ gives 5 in the quotient, &c.

CHAP.

CHAP. IV.

Addition and Subtraction of Surds, both Simple and Compound.

1. IF the Surds proposed be not of one kind, reduce them to one kind; and then if they be commensurable multiply the Sum of the rational quantities by the common measure, and the product shall be the Sum of the Surds proposed; or multiply the difference of the rational parts by the common measure, and the product shall be the difference of the Surds proposed; or instead of multiplying, subjoyn the rational part, to the Sum or difference of the rational parts.

Example in Species.

Admit $\sqrt{8b^2}$ to be added to $\sqrt{32b^2}$, their greatest common measure will be $\sqrt{8}$, by which they'l be reduced to their least terms $\sqrt{1b^2}$ and $\sqrt{4}$, that is $1b$ and $2b$ whose Sum $3b$ Squared, makes $9b^2$ and multiplyed by $\sqrt{8}$ the common measure makes $\sqrt{72b^2}$ the Sum of the two given Surds. But if we take $1b$ from $2b$ the remains $1b$ Squared is b^2 which multiplyed by $\sqrt{8}$ the greatest common measure makes $\sqrt{8b^2}$ the difference of the given Surds, which may otherwise be expressed thus according to the latter clause of the rule, $3b\sqrt{8}$ the Sum, $b\sqrt{8}$ the difference.

Examples in Numbers.

Admit $\sqrt{8}$ and $\sqrt{32}$ to be added, their greatest common measure is $\sqrt{8}$, by which they'l be brought to $\sqrt{1}$ and $\sqrt{4}$ or 1 and 4 whose Sum is 5 and difference 3, which Squared make 25 and 9, and being multiplied by $\sqrt{8}$ the common measure, makes $\sqrt{200}$ the Sum, or $\sqrt{72}$ the difference, which may stand otherwise thus $5\sqrt{8}$ the Sum, $3\sqrt{8}$ the difference.

To add $\sqrt{(3)}\,81$ to $\sqrt{(3)}\,192$, their greatest common measure is $\sqrt{3}$, and they in their least terms $\sqrt{(3)}\,27$ and $\sqrt{(3)}\,64$, that is, 3, and 4, the Sum whereof is 7 and diff. 1, which being cubed make 343 and 1, and these multiplied in $\sqrt{(3)}$ 3 the common measure make $\sqrt{(3)}\,1029$ for the Sum, and $\sqrt{(3)}\,3$ the difference, or thus $7\sqrt{(3)}\,3$ the Sum, and $1\sqrt{(3)}\,3$ the difference.

2. But

2. But if the quantities to be added or subtracted be incommensurable, add and subtract them by the signs $+$ and $-$; whence arise Surds Binomial and residual. Thus $\surd 6$ and $\surd 7$ their Sum is $\surd 6 + \surd 7$, and difference $\surd 7 - \surd 6$.

3. Incommensurable Square roots may be added or subtracted thus; To the Sum of the Squares of the given Surds, add their double rectangle, or subtract the said double rectangle from the Sum of the Squares, the Square root of the Sum or remainder is the Sum or difference of the Surds proposed.

As to find the Sum and difference of $\surd 14$ and $\surd 12$, their Squares are 14 and 12 whose Sum is 26, and the double rectangle of $\surd 14$ and $\surd 12$ is $2\surd 168$, and consequently $\surd : 26 + 2\surd 168:$ is the Sum, and $\surd : 26 - \surd 168:$ the difference.

4. When two commensurable Surds proposed are Fractions, or mixt quantities, if they have not a common denominator, reduce them to a common denominator in the least terms; then to find out the rational parts, divide only the two new Numerators severally by their greatest common measure, and proceed as before. As to find the Sum or difference of $\surd \frac{24}{25}$ and $\surd \frac{2}{3}$, reduced to a common denominator they will be $\surd \frac{72}{75}$ and $\surd \frac{50}{75}$ which divided by their common measure $\surd \frac{2}{75}$, brings them to $\surd \frac{36}{75}$ and $\surd \frac{25}{75}$ or $6\surd \frac{1}{75}$ and $5\surd \frac{1}{75}$ whose Sum is $11\surd \frac{1}{75}$ or $\surd \frac{121}{75}$, and their difference $1\surd \frac{1}{75}$.

Examples in Compound Surds.

	$\surd 4+8$	$5+\surd 32$	$6+\surd 18$	$\surd 192+3$
	$\surd 5+7$	$4+\surd 8$	$5+\surd 8$	$\surd 75-3$
Sum	$\surd 5+17$	$9+6\surd 2$	$11+5\surd 2$	$13\surd 3$
Diff.	$3-\surd 5$	$1+2\surd 2$	$1+\surd 2$	$3\surd 3+6$

	$15-2\surd 2$	$\surd 242-12$	$11\surd 2+\surd 75$
	$7+\surd 2$	$-\surd 50+8$	$8\surd 3+8\surd 3$
Sum	$22-\surd 2$	$6\surd 2-4$	$11\surd 2+21\surd 3$
Diff.	$8-3\surd 2$	$16\surd 2-20$	$11\surd 2-11\surd 3$

Multiplication of Compound Surds.

Observe the same method used in rational quantities.

Multiplicand	$b\surd b^3-aa$	$4+\surd 7$	$4-\surd 3$
Multiplior	$5b$	3	2
Product	$5b^2\surd b^3-5a^2b$	$12+\surd 63$	$8-\surd 12$

Mul-

Multiplicand	$3d+\surd bb$	$\surd 2+\surd 6$	$\surd 7-2$
Multiplior	$\surd bb$	$\surd 8$	6
Product	$3d\surd b^2+\surd b^4$	$4+\surd 48$	$\surd 252-12$

Multiplicand	$\surd bc+\surd c$	$18+\surd 54$
Multiplior	$\surd cn-\surd a$	$6-\surd 24$
	$-\surd bca-\surd ac$	$-18\surd 24-\surd 1296$
	$\surd bc^2n+\surd c^2n$	$108+6\surd 54$
	$\surd bc^2n+\surd c^2n-\surd bca-\surd ac$	$72 \text{———} 18\surd 6$

If a Binomial be to be multiplied by its correspondent Residual, take the difference of the Squares of the Parts for the Product; for $\overline{a+e} \times \overline{a-e}$ produceth a^2-e^2.

Involution in Binomials and Residuals, is more easily performed by the Table of *Powers*, thus:

Because $a+e$ ⊚ $2=a^2+2ae+e^2$: Therefore to ⊚ 2 any Binomial, take the Squares of the Parts, and twice their Product.

And to ⊚ 2 any Residual, from the Sum of the Squares of the Parts, subtract a double Rectangle; because $\overline{a-e} \times \overline{a-e}=a^2-2ae+e^2$.

Thus may any Binomial, Trinomial, or Quadrinomial, &c. be involved as often as you please, by observing the result of so many rational Nomes so often involved.

Thus the Square of $3+\surd 6$ is $15+6\surd 6$; the Square of $a+\surd b$ is $a^2+b+2a\surd b$; the Square of $3-\surd 6$ is $15-6\surd 6$; of $\surd 7+\surd 4$ is $11+2\surd 28$; of $5+\surd 3$ is $28+10\surd 3$; and of $4-\surd 7$ is $23-8\surd 7$; and the Cube of $\surd 7+\surd 5$ is $74+21\surd 5+15\surd 7$.

CHAP. V.

Diviſion of Compound Surds.

Reduction neceſſary to precede Diviſion.

If a Binomial, conſiſting of two Simple Square Roots, or of one Square Root and a Rational Quantity, be multiplied by its correſpondent Reſidual, the Product will be a Rational Quantity.

If a Binomial, conſiſting of two Biquadratic Simple Roots, or of one Biquadratic Root and a Rational Quantity, be multiplied by its correſpondent Reſidual, the Product will be a Reſidual, conſiſting of two Square Roots, or of one Square Root and a Rational Quantity, which being multiplied by its Binomial, as above, produceth a Rational Quantity.

If a Trinomial, conſiſting of three Simple Square Roots, be multiplied by the ſame Trinomial, having one of its Signs changed, the Product will be either a Binomial or Reſidual, which being multiplied by its correſpondent Reſidual or Binomial, produceth a Quantity wholly Rational.

If a Quadrinomial, conſiſting of four Simple Square Roots, be multiplied by the ſame Quadrinomial, with two Signs changed, the Product will be a Trinomial, which may (by the Parag. above) be reduced to a Binomial, and that to a Quantity entirely Rational.

When a Binomial or Reſidual, conſiſting of two Simple Cubic or Biquadratic Roots, &c. or of one Cubic or Biquadratic Root, &c. and a Rational Quantity, is propoſed for a diviſor; find ſo many continual Proportionals in the proportion of the Parts of the Binomial or Reſidual propoſed, as there be Unites in the Index of the Radical Sign, and ſuch whoſe Radical Sign may be the ſame with that of the parts of the Binomial or Reſidual, but conjoyned in the Binomial by +, and in the Proportionals by + and — alternately; or contrarily, in the Proportionals by +, and in the Reſidual by + and —; the Product of the ſaid Proportionals ſo connexed multiplied in the Binomial or Reſidual, will be a Quantity entirely Rational.

After

After the ſame manner may a Binomial or Reſidual, having 5 or 6, &c. for the Index of the common Radical Sign of the Roots, be reduced to a Quantity entirely Rational. And note, that when the Roots are of different kinds, they muſt firſt be reduced to a common Radical Sign.

If the Diviſor be a Simple Quantity, divide each part of the Dividend by the Diviſor, (according to the Directions in Diviſion of *Simple Species*) and connex thoſe particular Products together by their Signs: But if the Diviſor be a Binomial, Trinomial, or Quadrinomial, &c. of ſuch kind as before is ſpecified, reduce the given Diviſor to a new Diviſor that may be a Simple Rational Quantity. Reduce alſo the given Dividend to a new Dividend, by multiplying the former by the ſame Quantities that were Multiplicators, in reducing the given Diviſor to a Rational Quantity; then divide the new Dividend by the new Diviſor. But when the Diviſor cannot be reduced to a Simple Rational Quantity, ſet the Dividend as a Numerator over the Diviſor as a Denominator.

Thus $12+\sqrt{63}$ divided by 3, the Quotient is $4+\sqrt{7}$; and $8-\sqrt{12}$ divided by 2, the Quotient is $4-\sqrt{3}$; $\sqrt{21}+\sqrt{15}$ divided by $\sqrt{3}$, the Quotient is $\sqrt{7}+\sqrt{5}$; $\sqrt{56}+\sqrt{24}$ divided by $\sqrt{6}$, the Quotient is $\sqrt{9\frac{2}{6}}+2$; and $\sqrt{(3)}28-\sqrt{(3)}14$ divided by $\sqrt{(3)}7$, the Quotient is $\sqrt{(3)}4-\sqrt{(3)}2$.

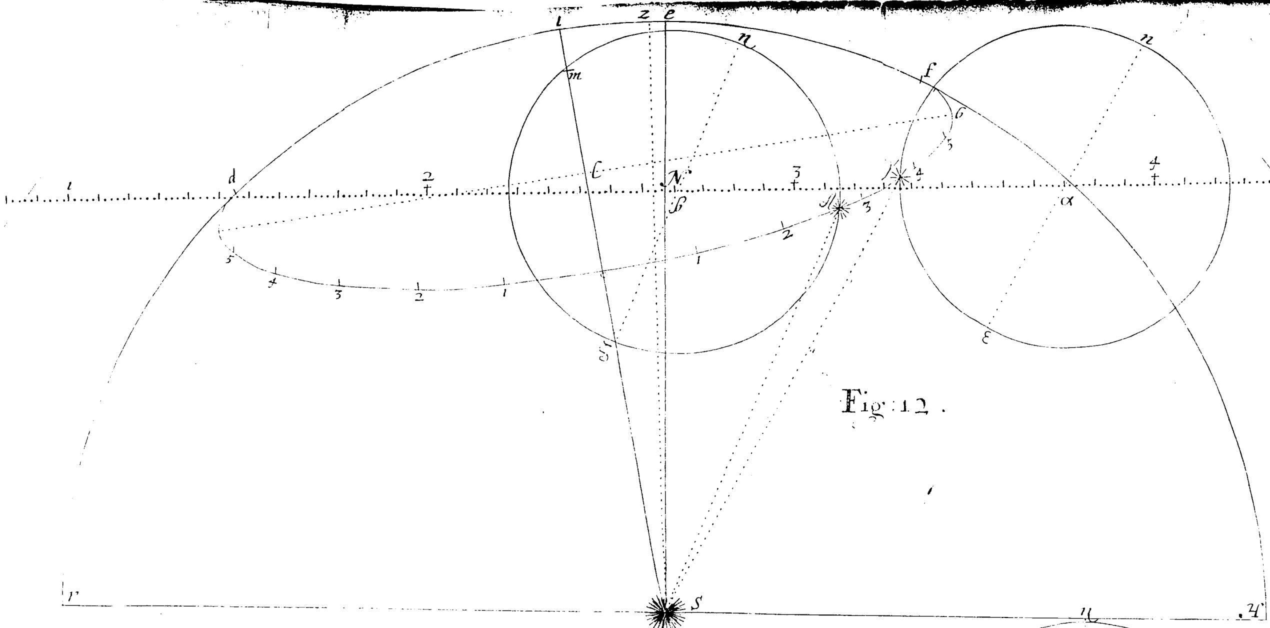
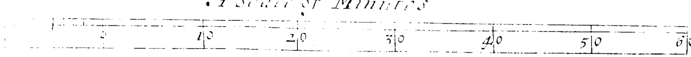


Fig: 12.

A Scale of Minutes



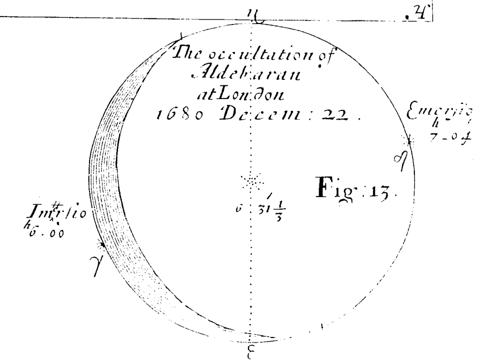
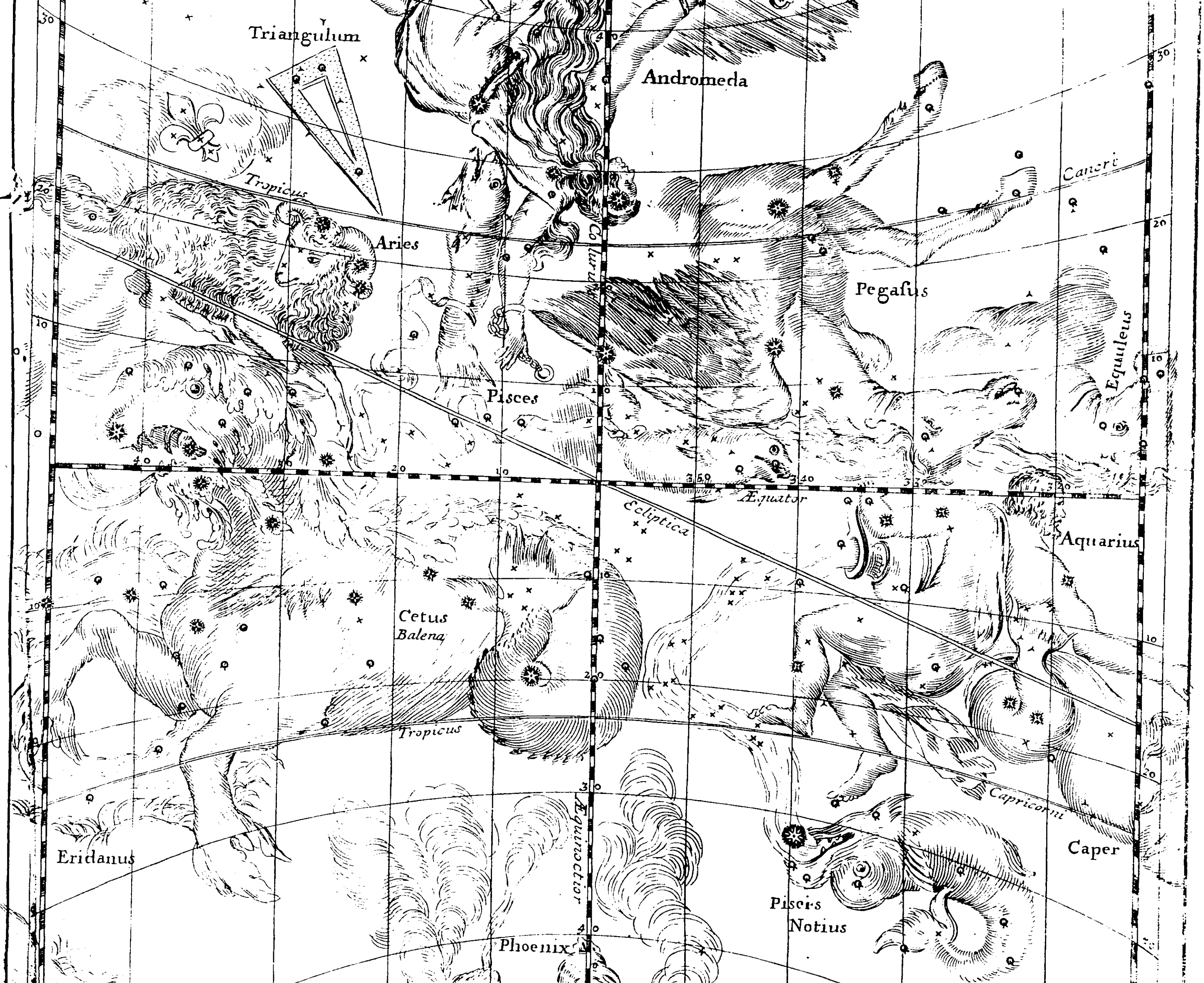


Fig: 13.

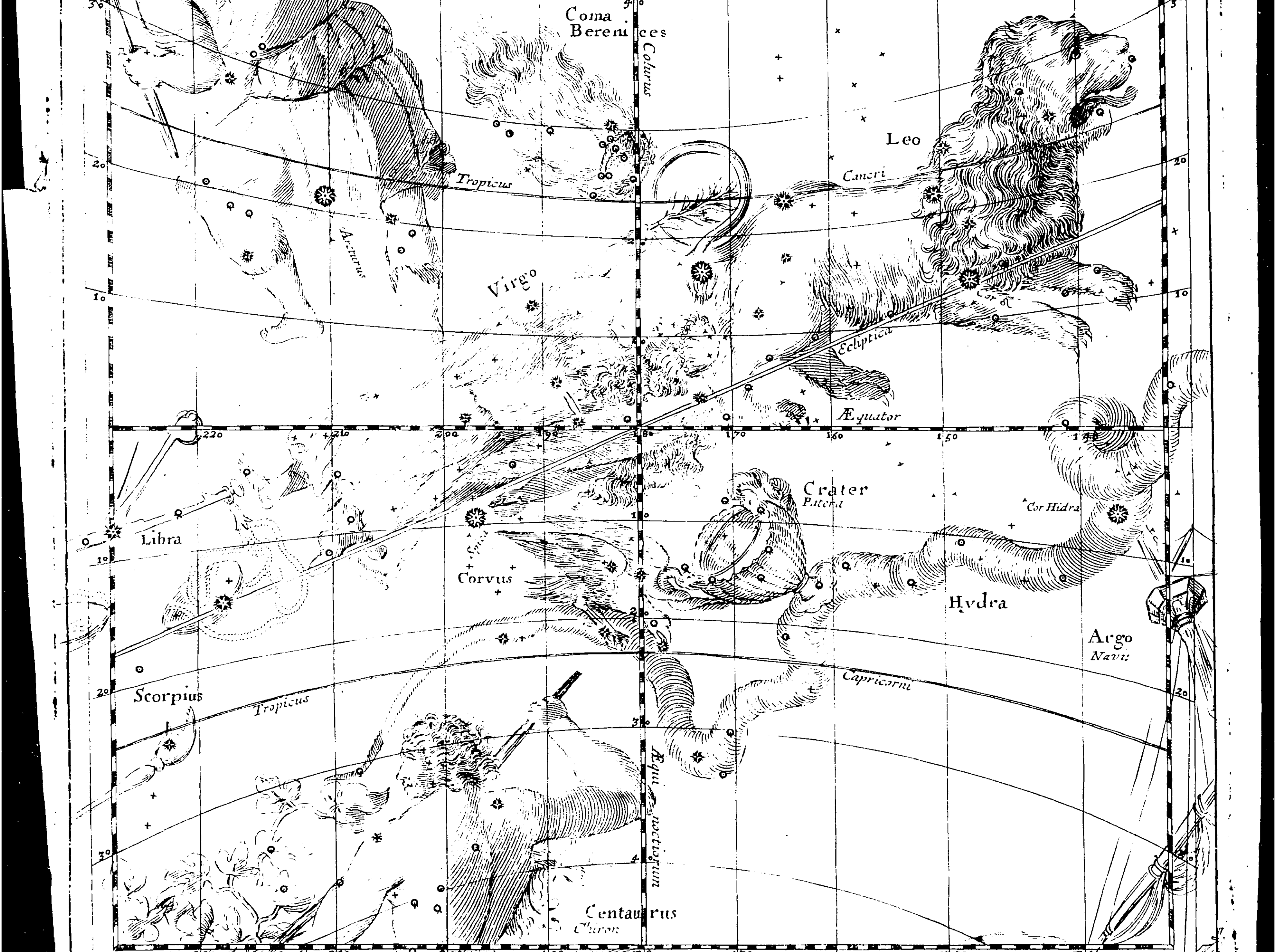
Between page 66 and 67 the Doctrine of the Sphere.



Triangulum
Andromeda
Tropicus
Cancri
Aries
Colurus
Pegasus
Equuleus
Pisces
Æquator
Ecliptica
Aquarius
Cetus
Balena
Tropicus
Capricorni
Caper
Eridanus
Æquinoctior
Piscis
Notius
Phoenix

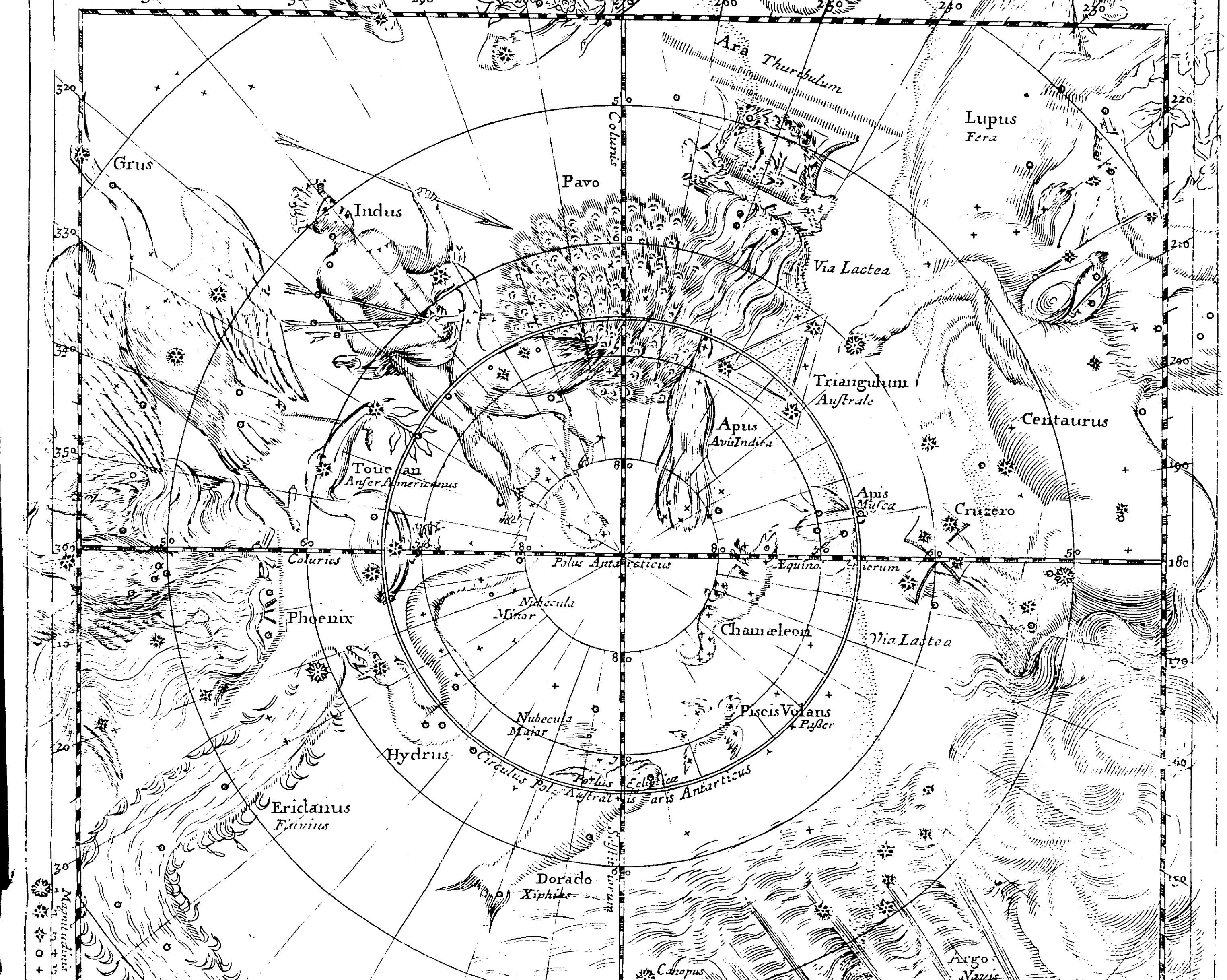

Hercules
Bootes
Cygnus
Olor
Draco
Colurus
Polus Eclipticæ Boreus
Via Lactea
Cepheus
Ursa Minor
Cynosura
Coluris
Æqui:
Polus Arcti
noctiorum
Solstitiorum
Circulus Polaris Arcticus
Cassiopea
Andromeda
Ursa Major
Helice
Perseus
Auriga
Heniochus

Perseus
Gemini
Taurus
Cancer
Tropicus
Cancri
Eclip
Hidra
Canis Minor
Via Lactea
Orion
Æquator
Solstitiorum
Coluris
Canis Major
Lepus
Eridanus
Tropicus
Capricorni
Argo Navis
Columba

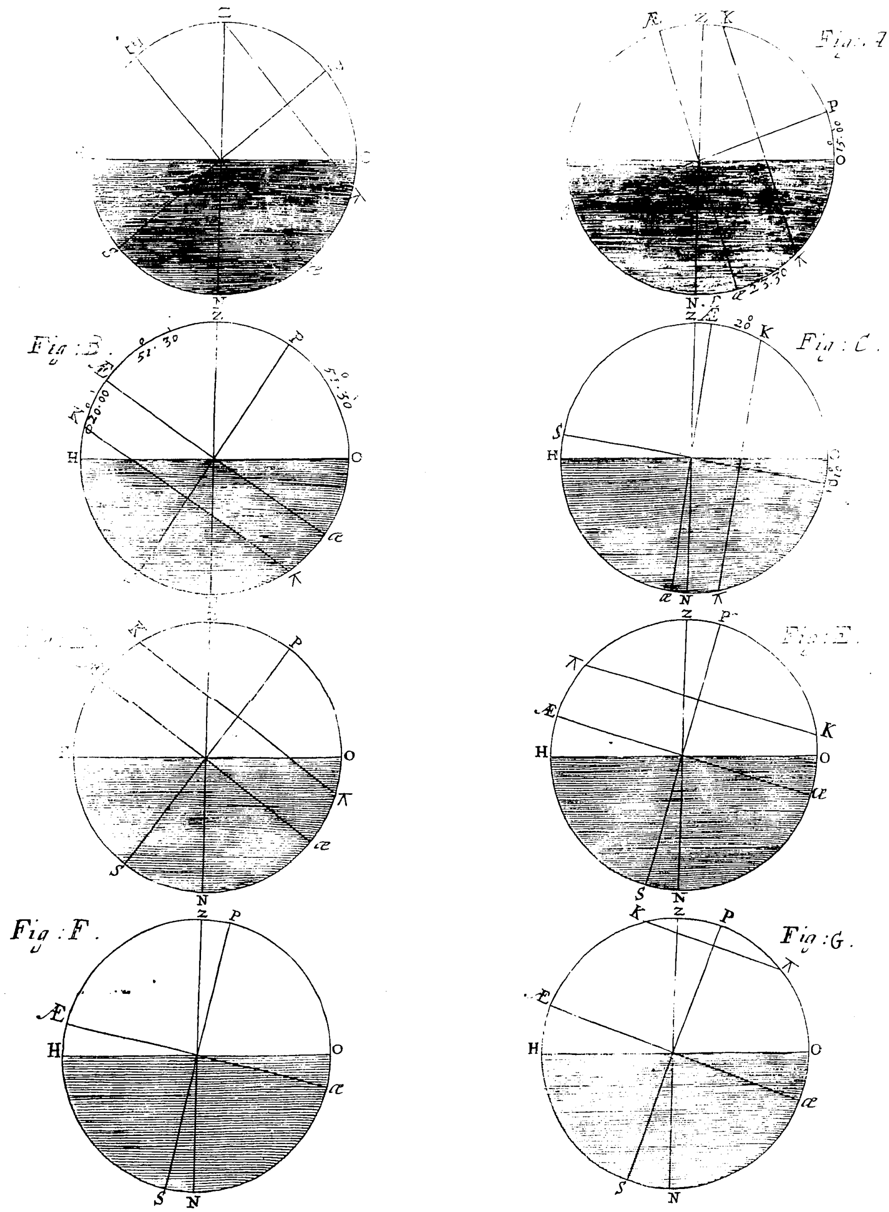


Coma
Berenices
Colurus
Leo
Tropicus
Cancri
Arcturus
Virgo
Ecliptica
Æquator
Crater
Patera
Cor Hidra
Libra
Corvus
Hydra
Argo
Navis
Scorpius
Tropicus
Capricorni
Æqui noctiorum
Centaurus
Chiron

Olor
Sygnus
Corona
Borea
Tropicus
Sagitta
Cancri
Via Lactea
Delphinus
Hercules
Engonasi
Colurus Solstitiorum
Aquila
Vultur Volans
Serpentarius
Ophiucus
Serpens
Ophiuchi
Equuleus
Equi Sectio
Æquator
Antinous
Ganimedes
Libra
Ecliptica
Caper
Tropicus
Scorpius
Capricorni
Via Lactea
Lupus
Sagittarius
Corona
Austri



Ara Thuribulum
Lupus
Fera
Grus
Indus
Pavo
Colurus
Via Lactea
Triangulum
Australe
Centaurus
Apus
Avis Indica
Toucan
Anser Americanus
Apis
Musca
Cruzero
Colurus
Polus Antarcticus
Equinoctiorum
Phoenix
Nubecula
Minor
Chamæleon
Via Lactea
Piscis Volans
Passer
Nubecula
Major
Hydrus
Polus Eclipticæ
Eridanus
Fluvius
Dorado
Xiphias
Canopus
Argo
Navis



H ÆZPON *represents the Meridian,* Æ æ *the Æquinoctiall,* K ⊼ *the Parrallel of* **Declination,** HO *the Horizon,* SP *the Axis of the Æquinoctiall,* ZN *the Axis of the Horizon and Prime verticall,* P *the North Pole,* S *the South Pole,* Z *the Zenith,* N *the Nadir,* H *the Southpoint of the Horizon,* O *the North Point.* HK or OK *the Meridian Altitude,* ZK *the Coalt: or Zenith distance,* ÆK *the Declination,* Z Æ *the Lat: =* OP *the Poles elevation*

between page 250 and 251 . Nauiga .

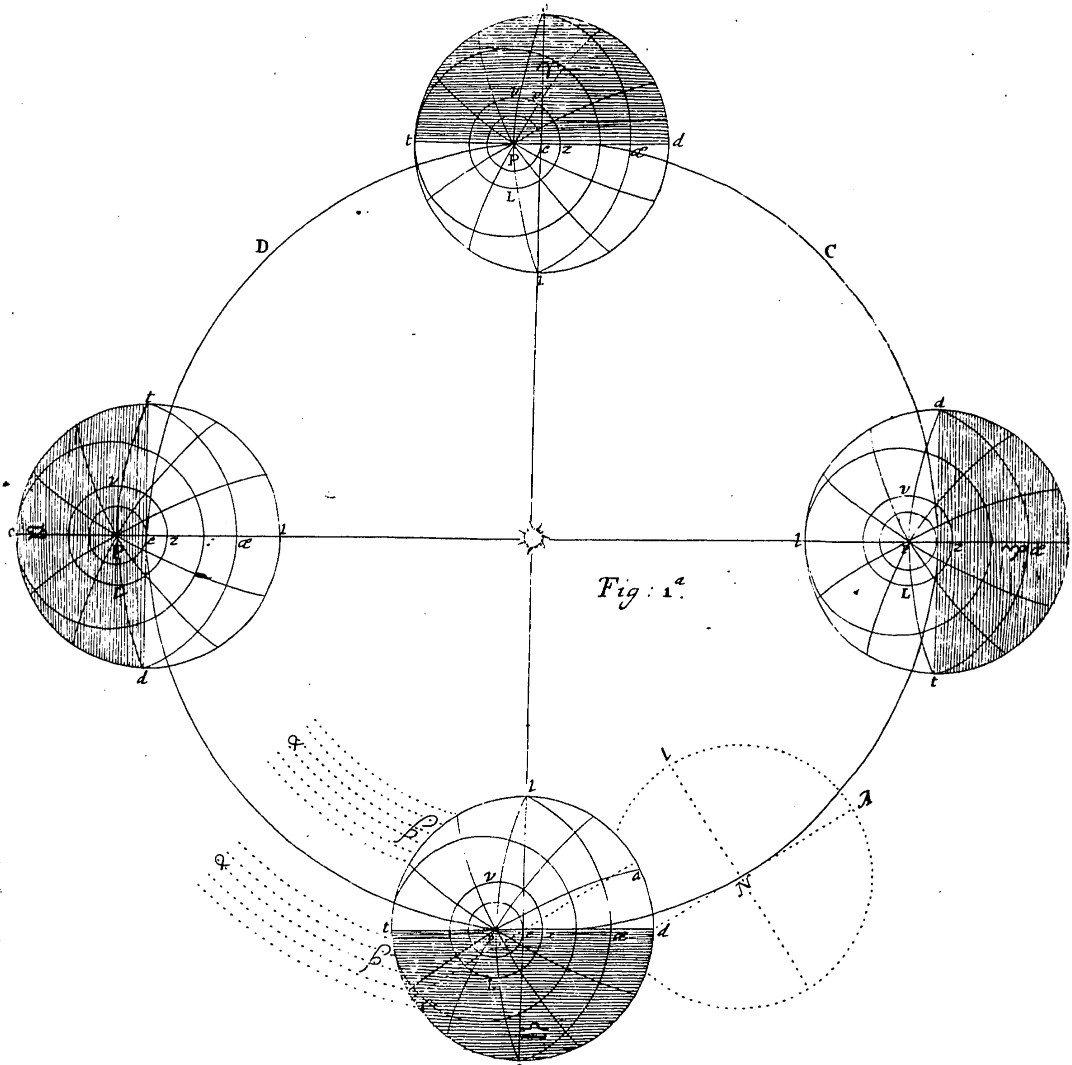


Fig: 1.ª

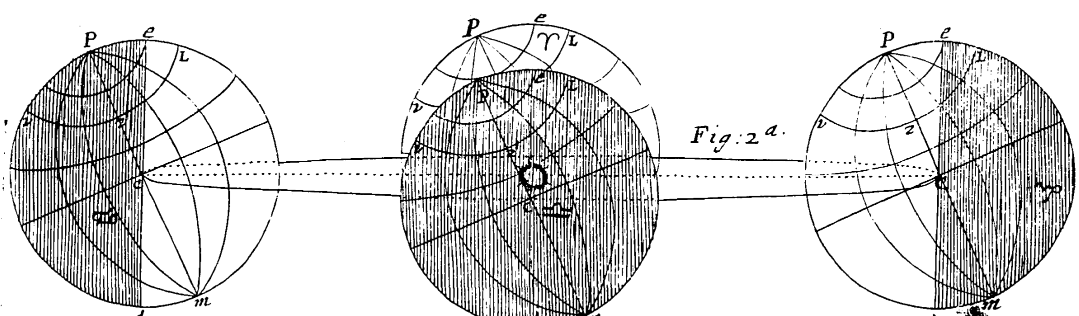
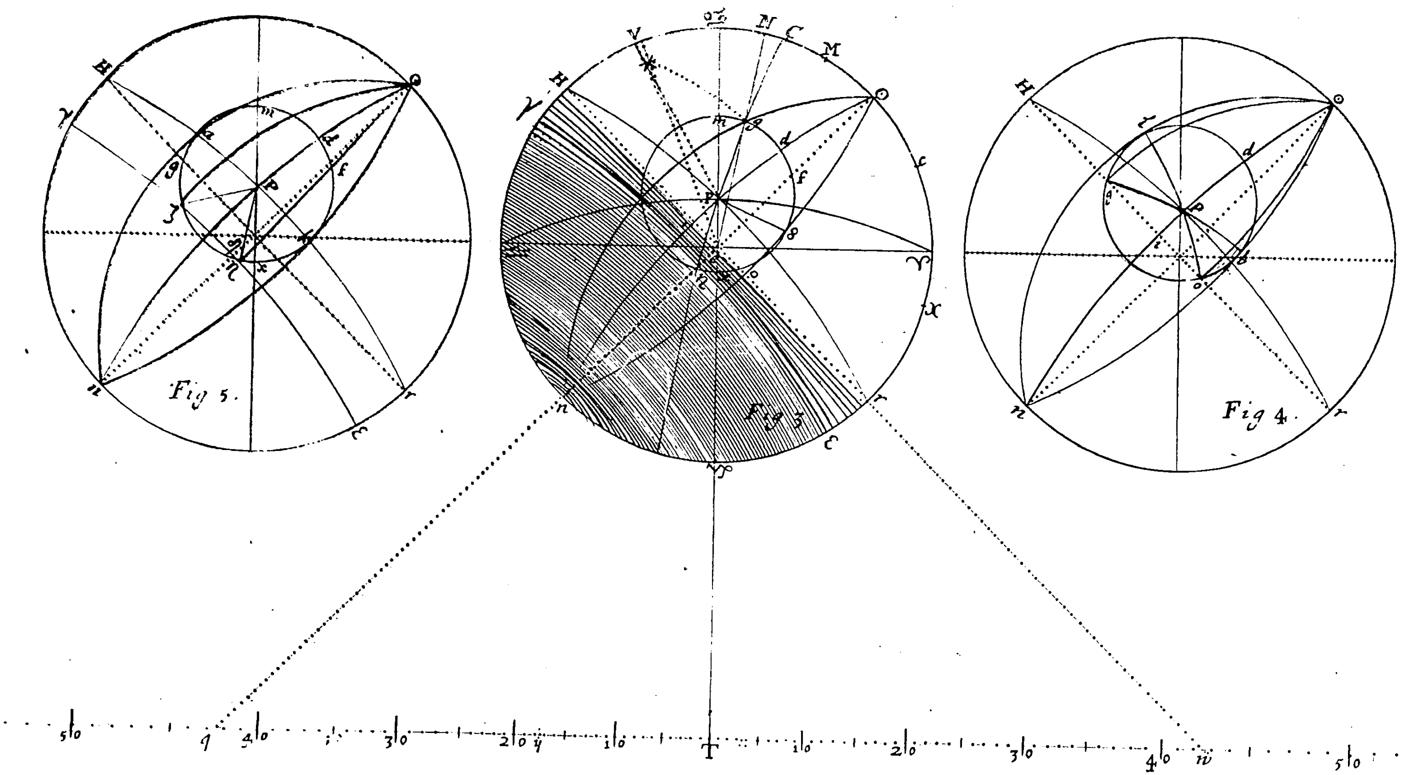


Fig: 2.ª

Place this between page 4 and 5 the Doctrine of the Sphere.



Place this between page 6 and 7 the Doctrine of the Sphere.

A NEW
SYSTEME
OF THE
MATHEMATICKS.

COMPOSED BY

Sir *JONAS MOORE*, K^{t}.

Late Surveyor General *of His* MAJESTY's Ordnance, *and* *Fellow of the* ROYAL SOCIETY:

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I. Astronomical TABLES, with Tables of *Logarithms*, Natural and Artificial *Sines* and *Tangents*, and *Versed Sines*, &c.

II. A New GEOGRAPHY, or a *Description* of the most Eminent *Countries* and *Coasts* of the WORLD, with *Maps* of them, and *Tables* of their *Latitude* and *Longitude*.

LONDON,
Printed by *A. Godbid* and *J. Playford*, for ROBERT SCOT, *Bookseller* in *Little Britain*, M. DC. LXXXI.

ASTRONOMICAL TABLES.

 A

Tables of Declination.

North Latitude.

♋	0 D.	0 M.	1 D.	1 M.	2 D.	2 M.	3 D.	3 M.	4 D.	4 M.	5 D.	5 M.	6 D.	6 M.	7 D.	7 M.	8 D.	8 M.	9 D.	9 M.	
0	23	32	24	32	25	32	26	32	27	32	28	32	29	32	30	32	31	32	32	32	30
1	23	31	24	31	25	3[illegible]	26	31	27	31	28	31	29	31	30	31	31	31	32	31	29
2	23	31	24	31	25	31	26	31	27	31	28	31	29	31	30	31	31	31	32	31	28
3	23	30	[illegible]4	30	25	30	26	30	27	30	28	30	29	30	30	30	31	30	32	30	27
4	23	28	24	29	25	2[illegible]	26	28	27	28	28	28	29	28	30	28	31	28	32	28	26
5	23	26	24	26	25	26	26	26	27	26	28	26	29	26	30	26	31	26	32	26	25
6	23	23	24	23	25	23	26	23	27	22	28	22	29	22	30	22	31	22	32	22	24
7	23	2[illegible]	24	20	25	20	26	20	27	19	28	19	29	19	30	19	31	19	32	19	23
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12	22	59	23	5[illegible]	24	59	25	59	26	58	27	5[illegible]	28	58	29	57	30	57	31	57	18
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17	22	2[illegible]	23	27	24	26	25	26	26	25	27	25	28	24	29	24	30	34	31	23	13
18	22	1[illegible]	23	19	24	1[illegible]	25	18	26	17	27	16	28	16	29	16	30	15	31	15	12
19	22	10	23	10	24	0[illegible]	25	09	26	08	27	07	28	06	29	06	30	05	31	05	11
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22	21	4[illegible]	22	43	23	42	24	41	25	40	26	39	27	38	28	38	29	37	30	36	8
23	21	3[illegible]	[illegible]2	33	23	32	24	31	25	30	26	29	27	28	28	28	29	27	30	25	7
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																					♊

Tables of Declination.

South Latitude.

♋	0 D.	0 M.	1 D.	1 M.	2 D.	2 M.	3 D.	3 M.	4 D.	4 M.	5 D.	5 M.	6 D.	6 M.	7 D.	7 M.	8 D.	8 M.	9 D.	9 M.	
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																					♊

Tables of Declination.

North Latitude.

	0		1		2		3		4		5		6		7		8		9		
♌	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	
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																					♉

Tables of Declination.

South Latitude.

	0		1		2		3		4		5		6		7		8		9		
♌	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	
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12	17	15	16	17	15	20	14	22	13	24	12	26	11	29	10	31	9	31	8	35	18
13	16	56	16	00	15	03	14	05	13	08	12	10	11	13	10	15	9	17	8	20	17
14	16	41	15	43	14	46	13	48	12	51	11	53	10	56	9	58	9	01	8	03	16
15	16	24	15	26	14	28	13	31	12	34	11	36	10	39	9	41	8	44	7	46	15
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17	15	48	14	50	13	53	12	56	11	59	11	01	10	04	9	07	8	10	7	14	13
18	15	29	14	32	13	35	12	38	11	41	10	43	9	46	8	49	7	52	6	55	12
19	15	11	14	14	13	17	12	20	11	23	10	25	9	28	8	31	7	34	6	37	11
20	14	52	13	55	12	58	12	01	11	04	10	07	9	10	8	13	7	16	6	19	10
21	14	33	13	36	12	39	11	42	10	45	9	48	8	51	7	54	6	57	6	00	9
22	14	14	13	17	12	20	11	23	10	26	9	29	8	32	7	35	6	38	5	41	8
23	13	54	12	58	12	01	11	04	10	07	9	10	8	13	7	16	6	19	5	22	7
24	13	34	12	38	11	41	10	44	9	48	8	51	7	54	6	57	6	00	5	03	6
25	13	14	12	18	11	21	10	24	9	28	8	31	7	35	6	38	5	41	4	44	5
26	12	54	11	59	11	01	10	04	9	08	8	11	7	15	6	18	5	22	4	05	4
27	12	33	11	36	10	39	9	43	8	47	7	50	6	54	5	57	5	01	4	25	3
28	12	13	11	17	10	20	9	24	8	28	7	31	6	35	5	37	4	42	3	46	2
29	11	52	10	56	10	00	9	04	8	07	7	11	6	15	5	17	4	22	3	26	1
30	11	31	10	35	9	39	8	43	7	46	6	50	5	54	4	57	4	01	3	05	0
																					♉

Tables of Declination.

North Latitude.

	0		1		2		3		4		5		6		7		8		9		
♍	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	
0	11	31	12	27	13	23	14	19	15	15	16	11	17	07	18	03	18	59	19	55	30
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2	10	48	11	45	12	41	13	36	14	32	15	28	16	24	17	20	18	16	19	21	28
3	10	26	11	23	12	19	13	14	14	10	15	06	16	02	16	58	17	54	18	49	27
4	10	05	11	01	11	57	12	52	13	48	14	44	15	40	16	36	17	31	18	27	26
5	9	43	10	39	11	35	12	30	13	26	14	22	15	18	16	14	17	09	18	04	25
6	9	21	10	17	11	13	12	08	13	04	14	00	14	55	15	51	16	46	17	41	24
7	8	58	9	55	10	51	11	46	12	42	13	37	14	33	15	28	16	23	17	18	23
8	8	36	9	32	10	28	11	23	12	19	13	14	14	10	15	05	16	00	16	55	22
9	8	13	9	10	10	06	11	01	11	56	12	52	13	47	14	42	15	37	16	32	21
10	7	51	8	47	9	42	10	38	11	33	12	29	13	24	14	19	15	14	16	06	20
11	7	28	8	23	9	18	10	14	11	09	12	05	13	00	13	55	14	50	15	45	19
12	7	05	8	00	8	55	9	51	10	46	11	42	12	37	13	32	14	27	15	22	18
13	6	42	7	37	8	32	9	28	10	23	11	19	12	14	13	09	14	04	14	59	17
14	6	19	7	14	8	09	9	05	10	00	10	56	11	51	12	46	13	41	14	36	16
15	5	56	6	52	7	47	8	42	9	37	10	33	11	28	12	23	13	18	14	13	15
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17	5	09	6	05	7	00	7	55	8	50	9	46	10	41	11	36	12	31	13	26	13
18	4	46	5	42	6	37	7	32	8	27	9	22	10	17	11	12	12	07	13	02	12
19	4	22	5	18	6	13	7	08	8	05	8	58	9	53	10	48	11	43	12	38	11
20	3	58	4	54	5	49	6	44	7	39	8	34	9	29	10	24	11	19	12	14	10
21	3	35	4	30	5	25	6	20	7	15	8	10	9	05	10	00	10	55	11	50	9
22	3	11	4	07	5	02	5	57	7	02	7	47	8	42	9	36	10	32	11	27	8
23	2	47	3	43	4	38	5	33	6	28	7	23	8	18	9	13	10	08	11	03	7
24	2	24	3	19	4	14	5	09	6	04	6	59	7	54	8	49	9	44	10	39	6
25	2	00	2	55	3	50	4	45	5	50	6	35	7	30	8	24	9	19	10	14	5
26	1	36	2	31	3	26	4	21	5	16	6	11	7	06	8	00	8	55	9	50	4
27	1	12	2	07	3	02	3	57	4	52	5	47	6	42	7	35	8	31	9	26	3
28	0	48	1	43	2	38	3	33	4	28	5	23	6	18	7	13	8	08	9	03	2
29	0	24	1	19	2	14	3	09	4	04	4	59	5	54	6	49	7	44	8	39	1
30	0	00	0	55	1	50	2	45	3	40	4	35	5	30	6	25	7	20	8	15	0
																					♈

Tables of Declination.

South Latitude.

	0		1		2		3		4		5		6		7		8		9		
♍	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	
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2	10	48	9	53	8	57	8	01	7	04	6	08	5	12	4	16	3	20	2	24	28
3	10	26	9	31	8	35	7	39	6	43	5	47	4	51	3	55	2	59	2	03	27
4	10	05	9	09	8	14	7	18	6	22	5	26	4	30	3	34	2	38	1	42	26
5	9	43	8	47	7	52	6	56	6	00	5	04	4	08	3	12	2	17	1	21	25
6	9	21	8	25	7	30	6	34	5	38	4	42	3	46	2	50	1	55	0	59	24
7	8	58	8	03	7	07	6	11	5	15	4	19	3	23	2	27	1	32	0	37	23
8	8	36	7	40	6	44	5	49	4	53	3	57	3	01	2	05	1	10	0	15	22
9	8	13	7	17	6	21	5	26	4	30	3	34	2	39	1	43	0	47	0	08	21
10	7	51	6	55	5	59	5	04	4	08	3	12	2	17	1	21	0	25	0	31	20
11	7	28	6	32	5	37	4	41	3	46	2	50	1	55	0	59	0	03	0	53	19
12	7	05	6	09	5	14	4	18	3	23	2	27	1	32	0	36	0	19	1	15	18
13	6	42	5	46	4	51	3	55	3	00	2	04	1	09	0	14	0	42	1	37	17
14	6	19	5	23	4	28	3	32	2	37	1	41	0	46	0	09	1	05	2	00	16
15	5	56	5	01	4	06	3	10	2	15	1	19	0	24	0	33	1	29	2	23	15
16	5	33	4	38	3	41	2	57	1	52	0	56	0	01	0	56	1	52	2	47	14
17	5	09	4	14	3	19	2	24	1	29	0	33	0	24	1	19	2	15	3	10	13
18	4	46	3	51	2	56	2	01	1	05	0	10	0	47	1	42	2	38	3	33	12
19	4	22	3	27	2	32	1	57	0	41	0	14	1	09	2	05	3	00	3	56	11
20	3	58	3	03	2	08	1	13	0	18	0	38	1	33	2	28	3	23	4	19	10
21	3	35	2	29	1	44	0	49	0	06	1	02	1	57	2	52	3	47	4	42	9
22	3	11	2	16	1	21	0	26	0	29	1	25	2	20	3	15	4	10	5	05	8
23	2	47	1	52	0	57	0	02	0	53	1	48	2	43	3	38	4	33	5	28	7
24	2	24	1	28	0	33	0	22	1	17	2	12	3	07	4	02	4	57	5	52	6
25	2	00	1	05	0	09	0	46	1	41	2	36	3	31	4	26	5	21	6	16	5
26	1	36	0	41	0	15	1	10	2	05	3	00	3	55	4	50	5	45	6	40	4
27	1	12	0	17	0	39	1	34	2	29	3	24	4	19	5	14	6	09	7	04	3
28	0	48	0	07	1	03	1	57	2	52	3	47	4	42	5	37	6	32	7	27	2
29	0	24	0	31	1	27	2	21	3	16	4	11	5	06	6	01	6	56	7	51	1
30	0	00	0	55	1	50	2	45	3	40	4	35	5	32	6	25	7	20	8	15	0
																					♈

Tables of Declination.

North Latitude.

♎	0		1		2		3		4		5		6		7		8		9		
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	
0	0	00	0	55	1	50	2	45	3	40	4	35	5	30	6	25	7	20	8	15	30
1	0	24	0	31	1	27	2	21	3	16	4	11	5	06	6	01	6	56	7	51	29
2	0	48	0	07	1	03	1	57	2	52	3	47	4	42	5	34	6	32	7	27	28
3	1	12	0	01	0	39	1	34	2	29	3	24	4	19	5	14	6	09	7	04	27
4	1	36	0	41	0	15	1	10	2	05	3	00	3	55	4	50	5	45	6	40	26
5	2	00	1	05	0	09	0	46	1	41	2	36	3	31	4	26	5	21	6	16	25
6	2	24	1	29	0	34	0	22	1	17	2	12	3	07	4	02	4	57	5	52	24
7	2	47	1	52	0	57	0	02	0	55	1	48	2	43	3	38	4	33	5	28	23
8	3	11	2	16	1	21	0	26	0	29	1	25	2	20	3	15	4	10	5	05	22
9	3	35	2	30	1	44	0	49	0	06	1	02	1	57	2	52	3	47	4	42	21
10	3	58	3	03	2	08	1	13	0	18	0	38	1	33	2	28	3	23	4	18	20
11	4	22	3	27	2	32	1	37	0	48	0	14	1	09	2	04	3	00	3	55	19
12	4	46	3	51	2	55	2	00	1	04	0	09	0	46	1	41	2	37	3	32	18
13	5	09	4	14	3	19	2	24	1	28	0	32	0	23	1	19	2	14	3	09	17
14	5	33	4	38	3	43	2	47	1	52	0	56	0	00	0	56	1	51	2	46	16
15	5	56	5	01	4	06	3	10	2	15	1	19	0	24	0	32	1	28	2	23	15
16	6	19	5	24	4	29	3	33	2	38	1	42	0	47	0	09	1	44	1	59	14
17	6	42	5	46	4	51	3	55	3	00	2	04	1	09	0	14	0	42	1	36	13
18	7	05	6	09	5	14	4	18	3	23	2	27	1	32	0	36	0	19	1	14	12
19	7	28	6	32	5	37	4	41	3	46	2	50	1	55	0	59	0	03	0	52	11
20	7	51	6	56	6	00	5	05	4	09	3	13	2	18	1	22	0	26	0	29	10
21	8	13	7	18	6	22	5	27	4	31	3	35	2	40	1	44	0	48	0	07	9
22	8	36	7	41	6	45	5	50	4	54	3	58	3	02	2	06	1	11	0	16	8
23	8	58	8	03	7	07	6	12	5	16	4	20	3	24	2	28	1	33	0	38	7
24	9	21	8	25	7	30	6	34	5	38	4	42	3	46	2	50	1	55	1	09	6
25	9	43	8	47	7	52	6	56	6	00	5	04	4	08	3	12	2	17	1	21	5
26	10	05	9	09	8	14	7	18	6	22	5	26	4	30	3	34	2	38	1	42	4
27	10	26	9	31	8	36	7	40	6	43	5	47	4	51	3	55	2	59	2	03	3
28	10	48	9	53	8	57	8	01	7	04	6	08	5	12	4	16	3	20	2	24	2
29	11	09	10	14	9	18	8	22	7	25	6	29	5	33	4	37	3	41	2	45	1
30	11	31	10	35	9	39	8	43	7	46	6	50	5	54	4	57	4	01	3	05	0
																					♓

Tables of Declination.

South Latitude.

♎	0		1		2		3		4		5		6		7		8		9		
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	
0	0	00	0	55	1	50	2	45	3	40	4	35	5	30	6	25	7	20	8	15	30
1	0	24	1	19	2	14	3	09	4	04	4	59	5	54	6	49	7	44	8	39	29
2	0	48	1	43	2	38	3	33	4	28	5	23	6	[illegible]	7	13	8	08	9	03	28
3	1	12	2	07	3	02	3	57	4	52	5	47	6	42	7	37	8	31	9	26	27
4	1	36	2	31	3	26	4	21	5	16	6	11	7	06	8	00	8	55	9	50	26
5	2	00	2	55	3	50	4	45	5	40	6	35	7	30	8	24	9	19	10	14	25
6	2	24	3	19	4	14	5	09	6	04	6	59	7	54	8	48	9	43	10	38	24
7	2	47	3	42	4	37	5	32	6	27	7	22	8	17	9	12	10	07	11	02	23
8	3	11	4	06	5	01	5	56	6	51	7	46	8	41	9	36	10	31	11	26	22
9	3	35	4	29	5	24	6	19	7	15	8	10	9	05	10	00	10	55	11	50	21
10	3	58	4	53	5	48	6	43	7	39	8	34	9	29	10	24	11	19	12	14	20
11	4	22	5	17	6	12	7	07	8	03	8	58	9	53	10	48	11	43	12	38	19
12	4	46	5	41	6	36	7	31	8	26	9	21	10	16	11	11	12	06	13	01	18
13	5	09	6	05	7	00	7	55	8	50	9	45	10	40	11	35	12	30	13	25	17
14	5	33	6	29	7	24	8	19	9	14	10	09	11	04	11	59	12	54	13	49	16
15	5	56	6	52	7	47	8	42	9	37	10	33	11	28	12	23	13	18	14	13	15
16	6	19	7	14	8	09	9	05	10	00	10	56	11	51	12	46	13	41	14	36	14
17	6	41	7	37	8	32	9	28	10	23	11	19	12	14	13	09	14	04	15	00	13
18	7	05	8	00	8	55	9	51	10	46	11	42	12	37	13	32	14	27	15	23	12
19	7	28	8	23	9	18	10	14	11	09	12	05	13	00	13	55	14	50	15	46	11
20	7	51	8	47	9	42	10	37	11	32	12	28	13	23	14	[illegible]	15	13	16	09	10
21	8	13	9	09	10	05	11	00	11	55	12	51	13	46	14	41	15	37	16	32	9
22	8	36	9	32	10	28	11	23	12	19	13	14	14	10	15	05	16	00	16	56	8
23	8	58	9	54	10	50	11	46	12	42	13	37	14	33	15	28	16	23	17	18	7
24	9	21	10	17	11	12	12	08	13	04	14	00	14	55	15	51	16	46	17	40	6
25	9	43	10	39	11	35	12	30	13	26	14	22	15	18	16	14	17	09	18	03	5
26	10	05	11	01	11	57	12	[illegible]	13	48	14	44	15	40	16	36	17	31	18	26	4
27	10	26	11	23	12	19	13	14	14	10	15	06	16	02	16	58	17	53	18	48	3
28	10	48	11	45	12	41	13	36	14	32	15	28	16	24	17	20	18	15	19	10	2
29	11	09	12	06	13	02	13	58	14	54	15	50	16	46	17	42	18	37	19	32	1
30	11	31	12	27	13	23	14	19	15	15	16	11	17	07	18	03	18	59	19	[illegible]	0
																					♓

Tables of Declination.

North Latitude.

	0		1		2		3		4		5		6		7		8		9		
m	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	
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1	11	52	10	56	10	00	9	04	8	07	7	11	6	15	5	18	4	22	3	26	29
2	12	13	11	17	10	20	9	24	8	28	7	31	6	35	5	38	4	42	3	46	28
3	12	33	11	37	10	40	9	44	8	48	7	51	6	55	5	58	5	02	4	06	27
4	12	54	11	58	11	01	10	04	9	08	8	11	7	15	6	18	5	22	4	26	26
5	13	14	12	18	11	21	10	24	9	28	8	31	7	35	6	38	5	42	4	46	25
6	13	34	12	38	11	41	10	44	9	48	8	51	7	54	6	57	6	01	5	05	24
7	13	54	12	58	12	01	11	04	10	07	9	10	8	13	7	16	6	20	5	24	23
8	14	14	13	17	12	20	11	23	10	26	9	29	8	32	7	35	6	39	5	42	22
9	14	33	13	36	12	39	11	42	10	45	9	48	8	51	7	54	6	57	6	00	21
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11	15	11	14	14	13	17	12	20	11	23	10	25	9	28	8	31	7	34	6	37	19
12	15	29	14	32	13	35	12	38	11	41	10	43	9	46	8	49	7	52	6	55	18
13	15	48	14	50	13	53	12	56	11	59	11	01	10	04	9	07	8	10	7	13	17
14	16	06	15	08	14	11	13	14	12	17	11	19	10	22	9	24	8	27	7	30	16
15	16	24	15	26	14	29	13	31	12	34	11	36	10	39	9	41	8	44	7	47	15
16	16	41	15	43	14	46	13	48	12	51	11	53	10	56	9	58	9	01	8	04	14
17	16	58	16	00	15	03	14	05	13	08	12	10	11	13	10	15	9	17	8	20	13
18	17	15	16	17	15	20	14	22	13	24	12	26	11	29	10	31	9	33	8	35	12
19	17	32	16	34	15	36	14	38	13	40	12	42	11	45	10	47	9	49	8	51	11
20	17	48	16	50	15	52	14	54	13	56	12	58	12	01	11	03	10	05	9	07	10
21	18	04	17	06	16	08	15	10	14	12	13	14	12	16	11	18	10	20	9	22	9
22	18	20	17	22	16	24	15	26	14	28	13	29	12	31	11	33	10	35	9	37	8
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Tables of Declination.

South Latitude.

	0		1		2		3		4		5		6		7		8		9		
m	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	
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3	12	33	13	29	14	25	15	21	16	18	17	14	18	10	19	06	20	02	20	58	27
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5	13	14	14	11	15	07	16	03	17	00	17	56	18	52	19	49	20	45	21	40	25
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7	13	54	14	51	15	47	16	44	17	40	18	37	19	33	20	30	21	26	22	21	23
8	14	14	15	11	16	07	17	04	18	00	18	57	19	53	20	50	21	46	22	42	22
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17	16	58	17	55	18	53	19	51	20	48	21	46	22	43	23	40	24	37	25	34	13
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Tables of Declination.

North Latitude.

♐	0 D.	0 M.	1 D.	1 M.	2 D.	2 M.	3 D.	3 M.	4 D.	4 M.	5 D.	5 M.	6 D.	6 M.	7 D.	7 M.	8 D.	8 M.	9 D.	9 M.	
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3	20	50	19	51	18	52	17	53	16	54	15	55	14	57	13	5[illegible]	12	4[illegible]	12	00	27
4	21	01	20	02	19	03	18	04	17	05	16	07	15	08	14	0[illegible]	13	10	12	11	26
5	21	13	20	13	19	15	18	16	17	17	16	18	15	19	14	1[illegible]	13	2[illegible]	12	21	25
6	21	23	20	24	19	25	18	26	17	27	16	28	15	28	14	29	13	30	12	31	24
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12	22	19	21	19	20	20	19	21	18	21	17	22	16	22	15	23	14	23	13	24	18
13	22	27	21	28	20	28	19	28	18	29	17	29	16	29	15	3[illegible]	14	20	13	31	17
14	22	34	21	35	20	35	19	35	18	36	17	36	16	36	15	37	14	37	13	37	16
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18	22	59	21	59	20	59	19	59	19	00	18	00	17	0[illegible]	16	01	15	01	14	01	12
19	23	04	22	04	21	04	20	04	19	05	18	05	17	05	16	06	15	06	14	06	11
20	23	09	22	09	21	09	20	09	19	10	18	10	17	10	16	10	15	10	14	10	10
21	23	1[illegible]	22	13	21	13	20	13	19	14	18	14	17	14	16	14	15	14	14	14	9
22	23	17	22	17	21	17	20	17	19	17	18	17	17	17	16	17	15	17	14	17	8
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																					♑

Tables of Declination.

South Latitude.

♐	0 D.	0 M.	1 D.	1 M.	2 D.	2 M.	3 D.	3 M.	4 D.	4 M.	5 D.	5 M.	6 D.	6 M.	7 D.	7 M.	8 D.	8 M.	9 D.	9 M.	
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3	20	50	21	49	22	48	23	47	24	45	25	44	26	43	27	42	28	40	29	38	27
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7	21	33	22	32	23	31	24	31	25	30	26	29	27	28	28	27	29	26	30	25	23
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18	22	59	23	59	24	59	25	58	26	58	27	58	28	57	29	57	30	57	31	56	12
19	23	04	24	04	25	04	26	03	27	03	28	03	29	02	30	02	31	02	32	02	11
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27	23	30	24	30	25	30	26	30	27	30	28	30	29	30	30	30	31	30	32	30	3
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29	23	31	24	31	25	31	26	31	27	31	28	31	29	31	30	31	31	31	32	31	1
30	23	32	24	32	25	32	26	32	27	32	28	32	29	32	30	32	31	32	32	32	0
																					♑

Tables of Right Ascension.

North Latitude.

	0		1		2		3		4		5		6		7		8		9	
♈	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	0	00	359	37	359	13	358	49	358	25	358	01	357	3[illegible]	357	13	356	48	356	23
1	0	55	0	32	0	08	359	44	359	20	358	56	358	32	358	08	357	43	357	18
2	1	50	1	27	1	03	0	39	0	15	359	51	359	2[illegible]	359	03	358	38	358	13
3	2	45	2	22	1	58	1	34	1	10	0	46	0	22	359	58	359	34	359	09
4	3	40	3	17	2	53	2	29	2	05	1	41	1	17	0	53	0	29	0	04
5	4	35	4	12	3	48	3	24	3	00	2	36	2	12	1	48	1	24	0	59
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13	11	57	11	33	11	09	10	46	10	22	9	58	9	34	9	10	8	46	8	22
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29	26	57	26	35	26	13	25	51	25	29	25	07	24	44	24	21	23	57	23	34
30	27	54	27	33	27	11	26	49	26	27	26	05	25	42	25	19	24	56	24	32

Tables of Right Ascension.

South Latitude.

	0		1		2		3		4		5		6		7		8		9	
♈	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
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2	1	50	2	13	2	37	3	01	3	25	3	49	4	13	4	37	5	01	5	25
3	2	45	3	08	3	32	3	56	4	20	4	44	5	08	5	32	5	56	6	20
4	3	40	4	03	4	27	4	51	5	15	5	39	6	03	6	27	6	51	7	15
5	4	35	4	58	5	22	5	46	6	10	6	34	6	58	7	22	7	46	8	09
6	5	30	5	54	6	18	6	42	7	05	7	30	7	53	8	17	8	41	9	04
7	6	25	6	49	7	13	7	37	8	01	8	25	8	48	9	12	9	36	9	59
8	7	21	7	44	8	08	8	32	8	56	9	20	9	43	10	07	10	30	10	53
9	8	16	8	40	9	04	9	28	9	51	10	15	10	38	11	02	11	25	11	48
10	9	11	9	3[illegible]	9	59	10	23	10	46	11	10	11	33	11	57	12	19	12	42
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26	24	06	24	28	24	50	25	12	25	34	25	5[illegible]	26	17	26	39	27	0[illegible]	27	22
27	25	02	25	25	25	47	26	0[illegible]	26	30	26	52	27	13	27	35	27	56	28	17
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29	26	57	27	19	27	40	28	01	28	22	28	44	29	05	29	26	29	47	30	0[illegible]
30	27	54	28	16	28	37	28	58	29	19	29	40	30	01	30	22	30	43	31	04

Tables of Right Ascension.

North Latitude.

♉	0		1		2		3		4		5		6		7		8		9	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	27	54	27	33	27	11	26	49	26	27	26	05	25	42	25	19	24	56	24	32
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2	29	49	29	27	29	06	28	45	28	23	28	01	27	38	27	16	26	53	26	30
3	30	46	30	25	30	04	29	43	29	21	28	59	28	37	28	15	27	52	27	29
4	31	44	31	23	31	02	30	41	30	19	29	58	29	36	29	14	28	51	28	28
5	32	42	32	21	32	00	31	39	31	18	30	57	30	35	30	13	29	50	29	27
6	33	40	33	20	32	59	32	38	32	17	31	56	31	34	31	12	30	50	30	27
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18	45	31	45	14	44	56	44	38	44	20	44	01	43	42	43	23	43	04	42	43
19	46	32	46	14	45	57	45	39	45	21	45	03	44	44	44	25	44	07	43	46
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21	48	33	48	16	47	59	47	42	47	25	47	05	46	49	46	31	46	13	45	54
22	49	34	49	17	49	00	48	44	48	27	48	09	47	52	47	34	47	16	46	58
23	50	35	50	18	50	02	49	46	49	29	49	12	48	55	48	37	48	20	48	03
24	51	36	51	20	51	04	50	48	50	32	50	15	49	58	49	41	49	24	49	07
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26	53	40	53	24	53	09	52	54	52	38	52	22	52	06	51	49	51	33	51	17
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29	56	46	56	32	56	18	56	03	55	49	55	34	55	18	55	03	54	48	54	32
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Tables of Right Ascension.

South Latitude.

♉	0		1		2		3		4		5		6		7		8		9	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
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3	30	46	31	07	31	28	31	49	32	10	32	31	32	51	33	11	33	31	33	51
4	31	44	32	05	32	25	32	46	33	07	33	27	33	47	34	07	34	27	34	46
5	32	42	33	03	33	23	33	43	34	04	34	24	34	44	35	04	35	23	35	42
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17	44	31	44	49	45	06	45	24	45	42	45	59	46	15	46	33	46	49	47	04
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19	46	32	46	49	47	06	47	23	47	40	47	57	48	13	48	2[illegible]	48	45	48	59
20	47	32	47	49	48	06	48	23	48	39	48	56	49	12	49	28	49	43	49	57
21	48	33	48	50	49	06	49	23	49	39	49	55	50	11	50	27	50	41	50	55
22	49	34	49	50	50	06	50	23	50	38	50	54	51	10	51	25	51	40	51	53
23	50	35	50	51	51	06	51	23	51	38	51	53	52	09	52	24	52	3[illegible]	52	51
24	51	36	51	52	52	07	52	23	52	38	52	53	53	08	53	23	53	37	53	49
25	52	38	52	53	53	08	53	24	53	38	53	53	54	08	54	22	54	36	54	48
26	53	40	53	55	54	09	54	24	54	38	54	53	55	07	55	21	55	3[illegible]	55	47
27	54	42	54	56	55	11	55	25	55	39	55	53	56	07	56	21	56	34	56	46
28	55	44	55	58	56	12	56	26	56	40	56	54	57	07	57	20	57	33	57	45
29	56	46	57	00	57	13	57	27	57	41	57	54	58	07	58	20	58	32	58	44
30	57	48	58	02	58	15	58	29	58	42	58	55	59	07	59	2[illegible]	59	32	59	43

Tables of Right Ascension.

North Latitude.

	0		1		2		3		4		5		6		7		8		9	
♊	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
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5	63	03	62	51	62	39	62	27	62	15	62	02	61	50	61	37	61	24	61	11
6	64	06	63	55	63	43	63	32	63	20	63	08	62	56	62	44	62	31	62	18
7	65	09	64	59	64	47	64	37	64	25	64	13	64	02	63	50	63	38	63	25
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9	67	17	67	07	66	57	66	47	66	36	66	25	66	14	66	03	65	52	65	41
10	68	21	68	11	68	02	67	52	67	42	67	31	67	21	67	10	67	00	66	49
11	69	25	69	16	69	07	68	57	68	48	68	38	68	28	68	18	68	08	67	57
12	70	29	70	21	70	12	70	03	69	54	69	45	69	35	69	26	69	16	69	05
13	71	34	71	26	71	17	71	09	71	00	70	51	70	42	70	33	70	24	70	14
14	72	38	72	31	72	22	72	15	72	06	71	58	71	49	71	41	71	32	71	23
15	73	43	73	36	73	28	73	21	73	13	73	05	72	57	72	49	72	41	72	32
16	74	47	74	41	74	33	74	27	74	19	74	12	74	04	73	57	73	49	73	41
17	75	52	75	46	75	39	75	33	75	26	75	19	75	12	75	05	74	58	74	50
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19	78	02	77	56	77	51	77	45	77	40	77	34	77	28	77	22	77	16	77	09
20	79	07	79	02	78	57	78	52	78	47	78	41	78	36	78	30	78	2[illegible]	78	18
21	80	12	80	08	80	03	79	59	79	54	79	49	79	44	79	39	79	34	79	28
22	81	17	81	13	81	09	81	05	81	01	80	56	80	52	80	48	80	43	80	37
23	82	22	82	18	82	15	82	11	82	08	82	04	82	00	81	57	81	52	81	47
24	83	28	83	24	83	21	83	18	83	15	83	11	83	09	83	06	83	02	82	57
25	84	33	84	30	84	27	84	25	84	22	84	20	84	17	84	15	84	17	84	07
26	85	38	85	36	85	33	85	32	85	29	85	28	85	25	85	24	85	21	85	18
27	86	44	86	42	86	40	86	39	86	37	86	36	86	34	86	33	86	3[illegible]	86	28
28	87	49	87	48	87	46	87	46	87	44	87	44	87	42	87	42	87	40	87	39
29	88	55	88	54	88	53	88	53	88	52	88	52	88	51	88	51	88	50	88	49
30	90	00	90	[illegible]	90	[illegible]	[illegible]	[illegible]	90	00	90	00	90	00	90	00	90	00	90	00

Tables of Right Ascension.

South Latitude.

	0		1		2		3		4		5		6		7		8		9	
♊	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	57	48	58	02	58	15	58	29	58	42	58	55	59	07	59	20	59	32	59	43
1	58	51	59	04	59	17	59	30	59	43	59	55	60	07	60	20	60	32	60	42
2	59	53	60	06	60	19	60	31	60	44	60	56	61	08	61	20	61	32	61	42
3	60	56	61	08	61	21	61	33	61	46	61	57	62	09	62	21	62	32	62	41
4	61	59	62	11	62	23	62	35	62	48	62	58	63	09	63	21	63	32	63	41
5	63	03	63	14	63	25	63	37	63	50	63	59	64	10	64	21	64	32	64	41
6	64	06	64	17	64	28	64	39	64	52	65	01	65	11	65	22	65	32	65	40
7	65	09	65	20	65	31	65	41	65	54	66	02	66	12	66	22	66	32	66	40
8	66	13	66	23	66	34	66	44	66	56	67	04	67	13	67	23	67	33	67	40
9	67	17	67	27	67	37	67	46	67	58	68	06	68	15	68	24	68	33	68	40
10	68	21	68	30	68	40	68	49	68	59	69	07	69	16	69	25	69	33	69	40
11	69	25	69	34	69	43	69	52	70	01	70	09	70	17	70	26	70	34	70	40
12	70	29	70	38	70	46	70	55	71	03	71	11	71	19	71	27	71	35	71	41
13	71	34	71	42	71	49	71	58	72	05	72	13	72	21	72	28	72	36	72	41
14	72	38	72	46	72	53	73	01	73	08	73	15	73	23	73	30	73	37	73	42
15	73	43	73	50	73	57	74	04	74	11	74	18	74	25	74	32	74	38	74	43
16	74	47	74	54	75	01	75	07	75	14	75	20	75	27	75	33	75	39	75	44
17	75	52	75	58	76	05	76	11	76	17	76	23	76	29	76	35	76	40	76	45
18	76	57	77	03	77	09	77	15	77	20	77	26	77	31	77	37	77	42	77	46
19	78	02	78	07	78	13	78	18	78	23	78	28	78	33	78	38	78	43	78	47
20	79	07	79	12	79	17	79	21	79	26	79	31	79	35	79	40	79	44	79	48
21	80	12	80	17	80	21	80	25	80	29	80	34	80	38	80	42	80	46	80	49
22	81	17	81	21	81	25	81	28	81	32	81	36	81	40	81	44	81	47	81	50
23	82	22	82	25	82	29	82	32	82	35	82	39	82	42	82	46	82	48	82	51
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25	84	33	84	35	84	37	84	40	84	42	84	45	84	47	84	50	84	51	84	53
26	85	38	85	40	85	45	85	44	85	45	85	48	85	49	85	52	85	53	85	54
27	86	44	86	45	86	46	86	48	86	49	86	51	86	52	86	54	86	55	86	55
28	87	49	87	50	87	50	87	52	87	52	87	54	87	54	87	56	87	56	87	57
29	88	55	88	55	88	55	88	56	88	56	88	57	88	57	88	58	88	58	88	58
30	90	00	90	00	90	00	90	00	90	00	90	00	90	00	90	00	90	00	90	00

Tables of Right Ascension.

North Latitude.

♋	0		1		2		3		4		5		6		7		8		9	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
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1	91	05	91	06	91	07	91	07	91	07	91	08	91	09	91	09	91	10	91	11
2	92	11	92	12	92	14	92	14	92	15	92	16	92	18	92	18	92	20	92	22
3	93	16	93	18	93	20	93	21	93	23	93	24	93	26	93	27	93	29	93	32
4	94	22	94	24	94	27	94	28	94	30	94	32	94	35	94	36	94	39	94	42
5	95	27	95	30	95	33	95	35	95	38	95	40	95	43	95	45	95	49	95	52
6	96	32	96	36	96	39	96	42	96	45	96	48	96	51	96	54	96	58	97	02
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9	99	48	99	52	99	57	100	01	100	07	100	12	100	16	100	21	100	26	100	31
10	100	53	100	58	101	03	101	08	101	14	101	19	101	24	101	30	101	35	101	40
11	100	58	102	04	102	09	102	15	102	21	102	26	102	32	102	38	102	44	102	50
12	103	03	103	0[illegible]	103	15	103	21	103	27	103	33	103	40	103	46	103	53	103	59
13	104	08	104	14	104	21	104	27	104	34	104	41	104	48	104	55	105	02	105	09
14	105	13	105	19	105	27	105	33	105	41	105	48	105	56	106	03	06	11	106	18
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16	107	22	107	29	107	38	107	45	107	53	108	02	108	11	108	19	108	28	108	36
17	108	26	108	34	108	43	108	53	108	59	109	0[illegible]	109	18	109	27	109	36	109	45
18	109	31	109	39	109	4[illegible]	109	57	110	05	110	15	110	25	110	34	110	44	110	54
19	110	35	110	44	110	53	111	03	111	12	111	22	111	32	11	42	112	52	112	02
20	111	39	111	4[illegible]	111	58	112	08	112	18	112	29	112	35	112	50	113	00	113	11
21	112	43	112	53	113	03	113	13	113	24	113	35	113	46	113	57	114	08	114	19
22	113	47	113	5[illegible]	114	08	114	18	114	30	114	41	114	52	115	04	115	15	115	27
23	114	51	115	01	115	13	115	23	115	35	115	47	115	58	116	10	116	22	116	35
24	115	54	116	05	116	17	116	28	116	41	116	52	117	04	117	17	117	29	117	42
25	116	57	117	0[illegible]	117	21	117	33	117	46	117	58	118	1[illegible]	118	23	118	36	118	49
26	118	0[illegible]	118	13	118	25	118	3[illegible]	118	51	119	03	119	16	119	29	119	4[illegible]	119	56
27	119	04	119	16	119	29	119	42	119	55	120	08	120	22	120	35	20	49	21	03
28	120	07	120	19	120	33	120	46	120	59	121	13	121	27	121	41	121	55	122	10
29	121	[illegible]	121	22	121	36	121	50	122	03	122	18	122	32	122	47	123	01	123	16
30	122	12	122	25	122	39	122	53	123	07	123	22	123	37	123	52	124	07	124	22

Tables of Right Ascension.

South Latitude.

♋	0		1		2		3		4		5		6		7		8		9	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	90	00	90	00	90	00	90	00	90	00	90	00	90	00	90	00	90	00	90	00
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2	92	11	92	10	92	10	92	08	92	08	92	06	92	06	92	04	92	04	92	03
3	93	16	93	15	93	14	93	12	93	11	93	09	93	08	93	06	93	05	93	05
4	94	22	94	20	94	19	94	16	94	15	94	12	94	11	94	08	94	07	94	06
5	95	27	95	25	95	23	95	20	95	18	95	15	95	13	95	10	95	09	95	07
6	96	32	96	30	96	27	96	24	96	21	96	18	96	15	96	12	96	10	96	08
7	97	38	97	35	97	31	97	28	97	25	97	21	97	18	97	14	97	12	97	09
8	98	43	98	39	98	35	98	32	98	28	98	24	98	20	98	16	98	13	98	10
9	99	48	99	43	99	39	99	35	99	31	99	26	99	22	99	18	99	14	99	11
10	100	53	100	48	100	43	100	39	100	34	100	29	100	25	100	20	100	16	100	12
11	101	58	101	53	101	47	101	42	101	37	101	32	101	27	101	22	101	17	100	12
12	103	03	102	57	102	51	102	45	102	40	102	34	102	29	102	23	102	18	101	12
13	104	08	104	02	103	55	103	49	103	43	103	37	103	31	103	25	103	20	102	13
14	105	13	105	06	104	59	104	52	104	46	104	40	104	33	104	27	104	21	103	14
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17	108	26	108	18	108	11	108	02	107	55	107	47	107	39	107	32	107	24	106	15
18	109	31	109	22	109	14	109	05	108	57	108	49	108	41	108	33	108	25	107	15
19	110	35	110	26	110	17	110	08	110	00	109	51	109	43	109	34	109	26	108	16
20	111	39	111	30	111	20	111	11	111	02	110	53	110	44	110	35	110	27	109	16
21	112	43	112	33	112	23	112	13	112	04	111	54	111	45	111	36	111	27	110	16
22	113	47	113	37	113	26	113	16	113	06	112	56	112	47	112	37	112	27	111	16
23	114	51	114	40	114	29	114	19	114	08	113	58	113	48	113	38	113	28	112	17
24	115	54	115	43	115	32	115	21	115	10	114	59	114	49	114	38	114	28	113	17
25	116	57	116	46	116	35	116	23	116	12	116	01	115	50	115	39	115	28	114	17
26	118	01	117	49	117	37	117	25	117	14	117	02	116	51	116	39	116	28	115	17
27	119	04	118	51	118	39	118	27	118	15	118	03	117	52	117	39	117	28	116	17
28	120	07	119	54	119	41	119	29	119	16	119	04	118	52	118	40	118	28	117	16
29	121	09	120	56	120	43	120	30	120	17	120	05	119	5[illegible]	119	40	119	28	118	16
30	122	12	121	58	121	45	121	31	121	18	121	05	120	5[illegible]	120	40	120	28	119	15

Tables of Right Ascension.

North Latitude.

♌	0 D.	0 M.	1 D.	1 M.	2 D.	2 M.	3 D.	3 M.	4 D.	4 M.	5 D.	5 M.	6 D.	6 M.	7 D.	7 M.	8 D.	8 M.	9 D.	9 M.
0	122	12	122	25	122	39	122	53	123	07	123	22	123	37	123	52	124	07	124	22
1	123	14	123	28	123	42	123	57	124	11	124	26	124	42	124	57	125	12	125	28
2	124	16	124	31	124	45	125	00	125	15	125	30	125	46	126	02	126	17	126	33
3	125	18	125	33	125	48	126	03	126	18	126	34	126	50	127	06	127	22	127	38
4	126	20	126	36	126	51	127	06	127	22	127	38	127	54	128	11	128	27	128	43
5	127	22	127	38	127	54	128	09	128	25	128	42	128	58	129	15	129	32	129	48
6	128	24	128	40	128	56	129	12	129	28	129	45	130	02	130	19	130	36	130	53
7	129	25	129	42	129	58	130	14	130	31	130	48	131	05	131	23	131	40	131	58
8	130	26	130	43	131	00	131	16	131	33	131	51	132	08	132	26	132	44	133	02
9	131	27	131	44	132	01	132	18	132	35	132	53	133	11	133	29	133	47	134	06
10	132	28	132	45	133	02	133	20	133	37	133	55	134	14	134	32	134	50	135	09
11	133	28	133	46	134	03	134	21	134	39	134	57	135	16	135	35	135	53	136	12
12	134	29	134	47	135	04	135	22	135	40	135	59	136	18	136	37	136	56	137	15
13	135	29	135	47	136	05	136	23	136	41	137	00	137	20	137	39	137	58	138	17
14	136	29	136	47	137	06	137	24	137	42	138	01	138	21	138	41	139	00	139	20
15	137	29	137	47	138	06	138	24	138	43	139	02	139	22	139	42	140	02	40	22
16	138	29	138	47	139	06	139	25	139	44	140	03	140	24	140	44	141	04	141	24
17	139	28	139	47	140	06	140	25	140	45	141	04	141	25	141	45	142	06	142	26
18	140	28	140	46	141	06	141	25	141	45	142	05	142	26	142	46	143	07	143	27
19	141	27	141	46	142	06	142	25	142	45	143	06	143	27	143	47	144	08	144	28
20	142	26	142	45	143	05	143	25	143	45	144	06	144	27	144	48	145	09	145	29
21	143	25	143	44	144	04	144	24	144	45	145	06	145	27	145	48	146	09	146	30
22	144	23	144	43	145	03	145	24	145	45	146	06	146	27	146	48	147	10	147	31
23	145	22	145	42	146	02	146	23	146	44	147	05	147	27	147	48	148	10	148	31
24	146	20	146	40	147	01	147	22	147	43	148	04	148	26	148	48	149	10	149	31
25	147	18	147	39	148	00	148	21	148	42	149	03	149	25	149	47	150	10	150	31
26	148	16	148	37	148	58	149	19	149	41	150	02	150	24	150	46	151	09	151	31
27	149	14	149	35	149	56	150	17	150	39	151	01	151	23	151	45	152	08	152	31
28	150	11	150	33	150	54	151	15	151	37	151	59	152	22	152	44	153	07	153	29
29	151	09	151	30	151	52	152	13	152	35	152	57	153	20	153	43	154	06	154	28
30	152	06	152	27	152	49	153	11	153	33	153	55	154	18	154	42	155	04	155	27

Tables of Right Ascension.

South Latitude.

♌	0 D.	0 M.	1 D.	1 M.	2 D.	2 M.	3 D.	3 M.	4 D.	4 M.	5 D.	5 M.	6 D.	6 M.	7 D.	7 M.	8 D.	8 M.	9 D.	9 M.
0	122	12	121	58	121	45	121	31	121	18	121	05	120	53	120	40	120	28	120	15
1	123	14	123	00	122	47	122	33	122	19	122	06	121	53	121	40	121	29	121	15
2	124	16	124	02	123	48	123	34	123	20	123	06	122	53	122	40	122	27	122	14
3	125	19	125	03	124	49	124	35	124	21	124	07	123	53	123	39	123	26	123	13
4	125	20	126	05	125	51	125	36	125	22	125	07	124	53	124	39	124	25	124	12
5	126	22	127	07	126	52	126	36	126	22	126	07	125	52	125	38	125	24	125	11
6	128	24	128	08	127	53	127	37	127	22	127	07	126	52	126	37	126	23	126	09
7	129	25	129	09	128	54	128	37	128	22	128	07	127	51	127	36	127	22	127	07
8	130	26	130	10	129	54	129	37	129	22	129	06	128	50	128	35	128	20	128	03
9	131	27	131	10	130	54	130	37	130	21	130	05	129	49	129	33	129	18	129	05
10	132	28	132	11	131	54	131	37	131	21	131	04	130	48	130	32	130	17	130	01
11	133	28	133	11	132	54	132	37	132	20	132	03	131	47	131	31	131	15	130	58
12	134	29	134	11	133	54	133	37	133	19	133	02	132	46	132	29	132	13	131	56
13	135	29	135	11	134	54	134	36	134	18	134	01	133	45	133	27	133	11	132	54
14	136	29	136	11	135	53	135	35	135	17	135	00	134	43	134	25	134	09	133	51
15	137	29	137	10	136	52	136	34	136	16	135	58	135	41	135	23	135	06	134	48
16	138	29	138	10	137	51	137	33	137	15	136	57	136	39	136	21	136	04	135	45
17	139	28	139	09	138	50	138	32	138	14	137	55	137	37	137	19	137	02	136	42
18	140	27	140	08	139	49	139	30	139	13	138	53	138	35	138	17	137	59	137	39
19	141	27	141	07	140	48	140	29	140	10	139	51	139	33	139	15	138	56	138	36
20	142	26	142	06	141	47	141	27	141	08	140	49	140	31	140	12	139	53	139	33
21	143	24	143	04	142	45	142	25	142	06	141	47	141	28	141	09	140	50	140	30
22	144	23	144	03	143	43	143	23	143	04	142	45	142	25	142	06	141	47	141	27
23	145	22	145	01	144	41	144	21	144	02	143	42	143	22	143	03	142	44	142	24
24	146	20	145	59	145	39	145	19	144	59	144	39	144	19	143	59	143	40	143	20
25	147	18	146	57	146	37	146	17	145	56	145	36	145	16	144	56	144	37	144	16
26	148	16	147	55	147	35	147	14	146	53	146	33	146	13	145	53	145	33	145	12
27	149	14	148	53	148	32	148	11	147	50	147	29	147	09	146	49	146	29	146	08
28	150	11	149	50	149	29	149	08	148	47	148	26	148	06	147	46	147	25	147	04
29	151	09	150	47	150	26	150	05	149	44	149	23	149	03	148	42	148	21	148	00
30	152	06	151	44	151	23	151	02	150	41	150	20	149	59	149	38	149	17	148	56

Tables of Right Ascension.

North Latitude.

♍	0 D.	0 M.	1 D.	1 M.	2 D.	2 M.	3 D.	3 M.	4 D.	4 M.	5 D.	5 M.	6 D.	6 M.	7 D.	7 M.	8 D.	8 M.	9 D.	9 M.
0	152	06	152	27	152	49	153	11	153	33	153	55	154	18	154	41	155	04	155	27
1	153	04	153	25	153	47	154	09	154	31	154	53	155	16	155	39	156	03	156	26
2	154	01	154	22	154	44	155	06	155	29	155	51	156	14	156	37	157	01	157	25
3	154	58	155	19	155	41	156	03	156	26	156	49	157	12	157	35	157	59	158	23
4	155	54	156	16	156	39	157	01	157	24	157	47	158	10	158	33	158	57	159	21
5	156	51	157	13	157	36	157	58	158	21	158	44	159	08	159	31	159	55	160	19
6	157	48	158	10	158	33	158	55	159	18	159	41	160	05	160	28	160	52	161	16
7	158	44	159	07	159	30	159	51	160	15	160	38	161	02	161	25	161	49	162	13
8	159	40	160	04	160	27	160	49	161	12	161	35	161	59	162	22	162	46	163	10
9	160	37	161	00	161	23	161	46	162	09	162	32	162	56	163	19	163	43	164	07
10	161	33	161	56	162	19	162	42	163	06	163	29	163	53	164	16	164	40	165	04
11	162	29	162	52	163	15	163	38	164	02	164	25	164	49	165	13	165	37	166	01
12	163	25	163	50	164	11	164	34	164	58	165	21	165	45	166	09	166	33	166	58
13	164	20	164	44	165	07	165	30	165	54	166	18	166	42	167	06	167	30	167	54
14	165	16	165	40	166	03	166	26	166	50	167	14	167	38	168	02	168	26	168	50
15	166	12	166	35	166	59	167	22	167	46	168	10	168	34	168	58	169	22	169	46
16	167	07	167	31	167	55	168	18	168	42	169	06	169	30	169	54	170	18	170	42
17	168	03	168	27	168	51	169	14	169	38	170	02	170	26	170	50	171	14	171	38
18	168	58	169	23	169	46	170	09	170	33	170	57	171	21	171	45	172	09	172	34
19	169	54	170	18	170	42	171	05	171	29	171	53	172	17	172	41	173	05	173	30
20	170	49	171	13	171	37	172	01	172	25	172	49	173	13	173	37	174	01	174	25
21	171	44	172	08	172	32	172	56	173	20	173	44	174	08	174	32	174	56	175	21
22	172	39	173	03	173	27	173	51	174	15	174	39	175	03	175	27	175	51	176	16
23	173	35	173	59	174	22	174	46	175	10	175	34	175	58	176	22	176	46	177	12
24	174	30	174	53	175	17	175	41	176	05	176	29	176	53	177	17	177	41	178	07
25	175	25	175	48	176	12	176	36	177	00	177	24	177	48	178	12	178	36	179	02
26	176	20	176	43	177	07	177	31	177	56	178	19	178	43	179	07	179	3[illegible]	179	57
27	177	15	177	38	178	02	178	26	178	50	179	14	179	38	180	02	180	26	180	52
28	178	10	178	33	178	57	179	2[illegible]	179	45	180	09	180	3[illegible]	180	57	181	22	181	47
29	179	05	179	28	179	52	180	16	180	40	181	04	181	28	181	52	182	17	182	42
30	180	00	180	23	180	47	181	11	181	35	181	59	182	23	182	47	183	12	183	37

Tables of Right Ascension.

South Latitude.

♍	0 D.	0 M.	1 D.	1 M.	2 D.	2 M.	3 D.	3 M.	4 D.	4 M.	5 D.	5 M.	6 D.	6 M.	7 D.	7 M.	8 D.	8 M.	9 D.	9 M.
0	152	06	151	44	151	23	151	02	150	41	150	20	149	59	149	38	149	17	148	56
1	153	04	152	41	152	20	151	59	151	38	151	16	150	55	150	34	150	13	149	52
2	154	01	153	38	153	17	152	55	152	34	152	12	151	51	151	30	151	09	150	48
3	154	58	154	35	154	13	153	51	153	30	153	08	152	47	152	25	152	04	151	43
4	155	54	155	32	155	10	154	48	154	26	154	04	153	43	153	21	153	00	152	38
5	156	51	156	29	156	07	155	44	155	22	155	00	154	39	154	17	153	55	153	33
6	157	48	157	25	157	03	156	40	156	18	155	56	155	34	155	12	154	50	154	28
7	158	44	158	22	157	59	157	36	157	14	156	52	156	30	156	08	155	46	155	23
8	159	40	159	18	158	55	158	32	158	10	157	48	157	26	147	03	156	41	156	18
9	160	37	160	14	159	51	159	28	159	06	158	43	158	21	157	58	157	36	157	13
10	161	33	161	10	160	47	160	24	160	02	159	39	159	17	158	54	158	31	158	08
11	162	29	162	06	161	43	161	20	160	58	160	35	160	12	159	49	159	26	159	03
12	163	25	163	02	162	39	162	16	161	53	161	30	161	07	160	44	160	21	159	58
13	164	20	163	58	163	35	163	12	162	49	162	25	162	02	161	39	161	16	160	53
14	165	16	164	53	164	30	164	07	163	44	163	20	162	57	162	34	162	11	161	48
15	166	12	165	48	165	25	165	02	164	39	164	15	163	52	163	29	163	06	162	43
16	167	07	166	44	166	21	165	57	165	34	165	10	164	47	164	24	164	01	163	38
17	168	03	167	40	167	17	166	52	166	29	166	05	165	42	165	19	164	56	164	33
18	168	58	168	35	168	12	167	47	167	24	167	00	166	37	166	13	165	51	165	28
19	169	54	169	31	169	07	168	43	168	19	167	55	167	32	167	08	166	46	166	23
20	170	49	170	26	170	02	169	38	169	14	168	50	168	27	168	03	167	41	167	17
21	171	44	171	21	170	57	170	33	170	09	169	45	169	22	168	58	168	35	168	12
22	172	39	172	16	171	52	171	28	171	04	170	40	170	17	169	53	169	30	169	07
23	173	35	173	11	172	47	172	23	171	59	171	35	171	12	170	48	170	25	170	01
24	174	30	174	06	173	42	173	18	172	54	172	30	172	07	171	43	171	20	170	56
25	175	25	175	02	174	38	174	14	173	50	173	26	173	02	172	38	172	15	171	51
26	176	20	175	57	175	33	175	09	174	45	174	21	173	57	173	33	173	10	172	45
27	177	15	176	52	176	28	176	04	175	40	175	16	174	52	174	28	174	04	173	40
28	178	10	177	47	177	23	176	59	176	35	176	11	175	47	175	23	174	59	174	34
29	179	05	178	42	178	18	177	54	177	30	177	06	176	42	176	18	175	54	175	29
30	180	00	179	37	179	13	178	49	178	25	178	01	177	37	177	13	176	48	176	24

Tables of Right Ascension.

North Latitude.

♎	0		1		2		3		4		5		6		7		8		9	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	180	00	180	23	180	47	181	11	181	35	181	59	182	23	182	47	183	12	183	37
1	180	55	181	19	181	42	182	06	182	30	182	54	183	18	183	42	184	06	184	31
2	181	50	183	13	132	37	183	01	183	25	183	49	184	13	184	37	185	01	185	25
3	182	45	183	08	183	32	183	56	184	20	184	44	185	08	185	32	185	56	186	20
4	183	40	184	03	184	27	184	51	185	15	185	39	186	03	186	27	186	50	187	14
5	184	25	184	58	185	22	185	46	186	10	186	34	186	58	187	22	187	45	188	08
6	185	30	185	54	186	18	186	42	187	06	187	30	187	53	188	17	188	40	189	03
7	186	25	186	49	187	13	187	37	188	01	188	25	188	48	189	12	189	35	189	57
8	187	21	187	44	188	08	188	32	188	56	189	20	189	43	190	07	190	30	190	52
9	188	16	183	39	189	03	189	27	189	51	190	15	190	38	191	02	191	25	191	46
10	189	11	189	34	189	58	190	22	190	46	191	10	191	33	191	57	192	19	192	41
11	190	06	190	29	190	53	191	17	191	41	192	05	192	28	192	52	193	14	193	36
12	191	02	191	25	191	48	192	13	192	36	193	00	193	23	193	47	194	09	194	31
13	191	57	192	20	192	43	193	08	193	31	193	55	194	18	194	41	195	04	195	26
14	192	53	193	16	193	39	194	03	194	26	194	50	195	13	195	36	195	59	196	21
15	193	48	194	12	194	35	194	58	195	21	195	45	196	08	196	31	196	54	197	16
16	194	44	195	07	195	30	195	53	196	16	196	40	197	03	197	26	197	49	198	11
17	195	40	196	02	196	25	196	48	197	11	197	35	197	58	198	21	198	44	199	06
18	196	35	196	58	197	21	197	44	198	07	198	30	198	53	199	16	199	39	200	01
19	197	31	197	54	198	17	198	40	199	02	199	25	199	48	200	11	200	34	200	56
20	198	27	198	50	199	13	199	36	199	58	200	21	200	43	201	07	201	29	201	51
21	199	23	199	46	200	09	200	32	200	54	201	16	201	39	202	02	202	21	202	46
22	200	20	200	42	201	05	201	28	201	50	202	12	202	34	202	57	203	19	203	41
23	201	16	201	38	202	01	202	24	202	46	203	08	203	30	203	52	204	14	204	36
24	202	12	202	35	202	57	203	20	203	42	204	04	204	26	204	48	205	10	205	31
25	203	99	203	31	203	53	204	16	204	38	205	00	205	21	205	43	206	05	206	26
26	204	06	204	29	204	50	205	12	205	34	205	56	206	17	206	39	207	00	207	22
27	205	02	205	25	205	47	206	09	206	30	206	52	207	13	207	35	207	56	208	17
28	205	59	206	22	206	43	207	05	207	26	207	48	208	09	208	30	208	51	209	12
29	206	57	207	19	207	40	208	01	208	22	208	44	209	05	209	26	209	47	210	08
30	207	54	208	16	208	37	208	58	209	19	209	40	210	01	210	22	210	43	211	04

Tables of Right Ascension.

South Latitude.

♎	0		1		2		3		4		5		6		7		8		9	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	180	00	179	37	179	13	178	49	178	25	178	01	177	37	177	13	176	48	176	24
1	180	55	180	32	180	08	179	44	179	20	178	56	178	32	178	08	177	43	177	19
2	181	50	181	27	181	03	180	39	180	15	179	51	179	27	179	03	178	38	178	14
3	182	45	182	22	181	58	181	34	181	10	180	46	180	22	179	58	179	34	179	09
4	183	40	183	17	182	53	182	29	182	05	181	41	181	17	180	53	180	29	180	05
5	184	35	184	12	183	48	183	24	183	00	182	36	182	12	181	48	181	24	181	00
6	185	30	185	07	184	43	184	19	183	55	183	31	183	07	182	43	182	19	181	55
7	186	25	186	02	185	38	185	14	184	50	184	26	184	02	183	38	183	14	182	50
8	187	21	186	57	186	33	186	09	185	45	185	21	184	57	184	33	184	09	183	45
9	188	16	187	52	187	28	187	04	186	40	186	16	185	52	185	23	185	04	184	41
10	189	11	188	47	188	23	187	59	187	35	187	11	186	47	186	23	185	59	185	36
11	190	06	189	42	189	18	188	55	188	31	188	07	187	43	187	18	186	55	186	32
12	191	02	190	38	190	14	189	51	189	27	189	03	188	39	188	14	187	51	187	27
13	191	57	191	33	191	09	190	46	190	22	189	58	189	34	189	10	188	46	188	23
14	192	53	192	29	192	05	191	42	191	18	190	54	190	30	190	06	189	42	189	18
15	193	48	193	25	193	01	192	38	192	14	191	50	191	26	191	02	190	38	190	14
16	194	44	194	20	193	57	193	34	193	10	192	46	192	22	191	58	191	34	191	10
17	195	40	195	16	194	53	194	30	194	06	193	42	193	18	192	54	192	30	192	06
18	196	35	196	12	195	49	195	26	195	02	194	39	194	15	193	51	193	27	193	02
19	197	31	197	09	196	45	196	22	195	58	195	35	195	11	194	47	194	23	193	59
20	198	27	198	04	197	41	197	18	196	54	196	31	196	07	195	44	195	20	194	55
21	199	23	199	00	198	37	198	14	197	51	197	28	197	04	196	41	196	17	195	52
22	200	20	199	56	199	33	199	11	198	48	198	25	198	01	197	38	197	14	196	49
23	201	16	200	53	200	30	200	08	199	45	199	22	198	58	198	35	198	11	197	46
24	202	12	201	50	201	27	201	05	200	42	200	19	199	55	199	32	199	08	198	44
25	203	09	202	47	203	14	202	02	201	39	201	16	200	52	200	29	200	05	199	41
26	204	06	203	44	203	21	202	59	202	36	202	13	201	50	201	27	201	03	200	39
27	205	02	204	41	204	19	203	57	203	34	203	11	202	48	202	25	202	01	201	37
28	205	59	205	38	205	16	204	54	204	31	204	09	203	46	203	23	202	59	202	35
29	206	57	206	35	206	13	205	51	205	29	205	07	204	44	204	21	203	57	203	34
30	207	54	207	33	207	11	206	49	206	27	206	05	205	42	205	19	204	56	204	33

Tables of Right Afcenfion.

North Latitude.

	0		1		2		3		4		5		6		7		8		9	
m	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	207	54	208	16	208	37	208	58	209	19	209	40	210	01	210	22	210	43	211	04
1	208	51	209	13	209	34	209	55	210	16	210	37	210	57	211	18	211	39	211	59
2	209	49	210	10	210	31	210	52	211	13	211	34	211	54	212	14	212	35	212	55
3	210	46	211	17	211	28	211	49	212	10	212	31	212	51	213	11	213	31	213	41
4	211	44	212	05	212	25	212	46	213	07	213	27	213	47	214	07	214	27	214	47
5	212	42	213	03	213	23	213	43	214	04	214	24	214	44	215	04	215	23	215	43
6	213	40	214	01	214	21	214	41	215	01	215	21	215	41	216	01	216	20	216	39
7	214	38	214	59	215	19	215	39	215	58	216	18	216	38	216	57	217	16	217	35
8	215	37	215	57	216	17	216	37	216	56	217	15	217	35	217	54	218	13	218	32
9	216	36	216	56	217	15	217	35	217	54	218	13	218	32	218	51	219	10	219	29
10	217	34	217	54	218	13	218	33	218	52	219	11	219	29	219	48	220	07	220	26
11	218	33	218	53	219	12	219	31	219	50	220	09	220	27	220	45	221	04	221	23
12	219	33	219	52	220	11	220	30	220	48	221	07	221	25	221	43	222	01	222	20
13	220	32	220	51	221	10	221	28	221	46	222	05	222	23	222	41	222	58	223	17
14	221	31	221	50	222	09	222	27	222	45	223	03	223	21	223	39	223	56	224	14
15	222	31	222	50	223	08	223	26	223	44	224	02	224	19	224	37	224	54	225	11
16	223	31	223	49	224	07	224	25	224	43	225	00	225	17	225	35	225	51	226	08
17	224	31	224	49	225	06	225	24	225	42	225	59	226	15	226	33	226	49	227	05
18	225	31	225	49	226	06	226	23	226	41	226	58	227	14	227	31	227	47	228	03
19	226	32	226	49	227	06	227	23	227	40	227	57	228	13	228	29	228	45	229	01
20	227	32	227	49	228	06	228	23	228	39	228	56	229	12	229	28	229	43	229	59
21	228	33	228	50	229	06	229	23	229	39	229	55	230	11	230	27	230	41	230	57
22	229	34	229	50	230	06	230	23	230	38	230	54	231	10	231	25	231	40	231	55
23	230	35	230	51	231	06	231	23	231	38	231	53	232	09	232	24	232	38	232	53
24	231	36	231	52	232	07	232	23	232	38	232	53	233	08	233	23	233	37	233	51
25	232	38	232	53	233	08	233	24	233	38	233	53	234	08	234	22	234	36	234	50
26	233	40	233	55	234	09	234	24	234	39	234	53	235	07	235	21	235	35	235	49
27	234	41	234	57	235	11	235	25	235	39	235	53	236	07	236	21	236	34	236	47
28	235	43	235	58	236	12	236	26	236	40	236	54	237	07	237	20	237	33	237	46
29	236	46	237	00	237	14	237	27	237	41	237	54	238	07	238	20	238	32	238	45
30	237	48	238	02	238	15	238	[illegible]	238	42	238	55	239	07	239	20	239	32	239	44

Tables of Right Afcenfion.

South Latitude.

	0		1		2		3		4		5		6		7		8		9	
m	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	207	54	207	33	207	11	206	49	206	27	206	05	205	42	205	19	204	56	204	33
1	208	51	208	30	208	08	207	47	207	25	207	03	206	40	206	17	205	54	205	31
2	209	49	209	27	209	06	208	45	208	23	208	01	207	38	207	16	206	53	206	30
3	210	46	210	25	210	04	209	43	209	21	208	59	208	37	208	15	207	52	207	29
4	211	44	211	23	211	02	210	41	210	18	209	58	209	36	209	14	208	51	208	28
5	212	42	212	21	212	00	211	39	210	19	210	57	210	35	210	13	209	50	209	28
6	213	40	213	20	212	59	212	38	212	17	211	56	211	34	211	12	210	50	210	28
7	214	38	214	18	213	58	213	37	213	16	212	55	212	33	212	12	211	50	211	28
8	215	37	215	17	214	57	214	36	214	15	213	54	213	33	213	12	212	50	212	28
9	216	36	216	16	215	56	215	36	215	15	214	54	214	33	214	12	213	51	213	29
10	217	34	217	15	216	55	216	35	216	15	215	54	215	33	215	12	214	51	214	30
11	218	33	218	14	217	55	217	35	217	15	216	54	216	33	216	13	215	52	215	31
12	219	33	219	14	218	54	218	35	218	15	217	55	217	34	217	14	216	53	216	32
13	220	32	220	13	219	54	219	35	219	15	218	56	218	35	218	15	217	54	217	34
14	221	31	221	13	220	54	220	35	220	16	219	57	219	36	219	16	218	56	218	36
15	222	31	222	13	221	54	221	36	221	17	220	58	220	38	220	18	219	58	219	38
16	223	31	223	13	222	54	222	36	222	18	221	59	221	39	221	19	221	00	220	40
17	224	31	224	13	223	55	223	37	223	19	223	00	222	40	222	21	222	02	221	43
18	225	31	225	14	224	56	224	38	224	20	224	01	223	42	223	23	223	04	222	46
19	226	32	226	14	225	57	225	39	225	21	225	03	224	44	224	25	224	07	223	49
20	227	32	227	15	226	58	226	40	226	23	226	05	225	46	225	28	225	10	224	52
21	228	33	228	16	227	59	227	42	227	25	227	07	226	49	226	31	226	13	225	55
22	229	34	229	17	229	00	228	44	228	27	228	09	227	52	227	34	227	16	226	59
23	230	35	230	18	230	02	229	46	229	29	229	12	228	55	228	37	228	20	228	03
24	231	36	231	20	231	04	230	48	230	32	230	15	229	58	229	41	229	24	229	07
25	232	38	232	22	232	06	231	51	231	35	231	18	231	02	230	45	230	28	230	12
26	233	40	233	24	233	09	232	54	232	38	232	22	232	06	231	49	231	33	231	17
27	234	41	234	27	234	12	233	57	233	42	233	26	233	10	232	54	232	38	232	22
28	235	43	235	29	235	15	235	00	234	45	234	30	234	14	233	58	233	43	233	27
29	236	46	236	32	236	18	236	03	235	49	235	34	235	18	235	03	234	40	234	32
30	237	48	237	35	237	21	237	07	236	53	236	38	236	[illegible]	236	08	235	55	235	38

Tables of Right Afcenfion.

North Latitude.

	0		1		2		3		4		5		6		7		8		9	
♐	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	237	48	238	02	238	15	238	29	238	42	238	55	239	07	239	20	239	32	239	44
1	238	51	239	04	239	17	239	30	239	43	239	55	240	07	240	20	240	32	240	44
2	239	53	240	06	240	19	240	31	240	44	240	56	241	08	241	20	241	32	241	43
3	240	56	241	09	241	21	241	33	241	45	241	57	242	09	242	21	242	32	242	43
4	241	59	242	11	242	23	242	35	242	46	242	58	243	09	243	21	243	32	243	43
5	243	03	243	14	243	25	243	37	243	48	243	59	244	10	244	21	244	32	244	43
6	244	06	244	17	244	28	244	39	244	50	245	01	245	11	245	22	245	32	245	43
7	245	09	245	20	245	31	245	41	245	52	246	02	246	12	246	22	246	32	246	43
8	246	13	246	23	246	34	246	44	246	54	247	04	247	13	247	23	347	33	247	43
9	247	17	247	27	247	37	247	47	247	56	248	06	248	15	248	24	248	33	248	43
10	248	21	248	30	248	40	248	49	248	58	249	07	249	16	249	25	249	33	249	43
11	249	25	249	34	249	43	249	52	250	00	250	09	250	17	250	26	250	34	250	44
12	250	30	250	38	250	46	250	55	251	03	251	11	251	19	251	27	251	35	251	44
13	251	34	251	42	251	49	251	58	252	05	252	13	252	21	252	28	252	36	252	44
14	252	38	252	46	252	53	253	01	253	08	253	15	253	23	253	30	253	37	253	45
15	253	43	253	50	253	57	254	04	254	11	254	18	254	25	254	32	254	38	254	45
16	254	47	254	54	255	01	255	07	255	14	255	20	255	27	255	33	255	39	255	46
17	255	52	255	58	256	05	256	11	256	17	256	22	256	29	256	35	256	40	256	47
18	256	57	257	03	257	09	257	15	257	20	257	25	257	31	257	37	257	42	257	48
19	258	02	258	07	258	13	258	18	258	23	258	28	258	33	258	38	258	43	258	49
20	259	07	259	12	259	17	259	21	259	26	259	31	259	35	259	4	259	44	259	50
21	260	12	260	17	260	21	260	25	260	29	260	34	260	38	260	42	250	46	260	51
22	261	17	261	21	261	25	261	28	261	32	261	36	261	4	261	44	261	47	261	52
23	262	22	262	25	262	2	262	32	262	35	262	39	262	42	262	46	262	48	262	54
24	263	28	263	30	263	33	263	35	263	3	263	42	263	45	263	48	263	50	263	54
25	264	33	264	3	264	37	264	40	264	42	264	45	264	47	264	5	264	51	264	55
26	265	38	265	4	265	41	265	44	265	45	265	48	265	49	265	52	265	53	265	5
27	266	44	266	45	266	46	266	49	266	49	266	51	266	52	266	54	266	5	266	5
28	267	49	267	50	267	50	267	52	267	52	267	54	267	54	267	56	267	[illegible]	267	5
29	268	55	268	55	268	55	268	56	268	56	268	57	268	57	268	58	268	5	268	59
30	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00

Tables of Right Afcenfion.

South Latitude.

	0		1		2		3		4		5		6		7		8		9	
♐	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	237	48	237	35	237	21	237	07	236	53	236	38	236	23	236	08	235	53	235	38
1	238	51	238	38	238	24	238	10	237	57	237	42	237	28	237	13	236	59	236	45
2	239	53	239	41	239	28	239	14	239	01	238	47	238	33	238	19	238	05	237	51
3	240	56	240	44	240	31	240	18	240	05	239	52	239	38	239	25	239	11	238	58
4	241	59	241	47	241	35	241	22	241	10	240	57	240	44	240	31	240	17	240	05
5	243	03	242	51	242	39	242	27	242	15	242	02	241	50	241	37	241	24	241	12
6	244	06	243	55	243	43	243	32	243	20	243	08	242	56	242	44	242	31	242	19
7	245	09	244	59	244	47	244	37	244	25	244	13	244	02	243	50	243	38	243	26
8	246	13	246	03	245	52	245	42	245	30	245	19	245	08	244	56	244	45	244	34
9	247	17	247	07	246	57	246	47	246	36	246	25	246	14	246	03	245	52	245	41
10	248	21	248	11	248	02	247	52	247	42	247	31	247	21	247	10	247	00	246	49
11	249	25	249	16	249	07	248	57	248	48	248	38	248	28	248	18	248	08	247	57
12	250	29	250	21	250	12	250	03	249	54	249	45	249	35	249	26	249	16	249	06
13	251	34	251	26	251	17	251	09	251	00	250	51	250	42	250	33	250	24	250	14
14	252	38	252	31	252	22	252	15	252	06	251	58	251	49	251	41	251	32	251	23
15	253	43	253	36	253	28	253	21	253	13	253	05	252	57	252	49	252	41	252	32
16	254	47	254	41	254	33	254	27	254	19	254	12	254	04	253	57	253	49	253	41
17	255	52	255	46	255	39	255	33	255	26	255	19	255	12	255	05	254	58	254	51
18	256	57	256	51	256	45	256	39	256	33	256	27	256	20	256	14	256	07	256	00
19	258	02	257	56	257	51	257	45	257	40	257	34	257	28	257	22	257	16	257	10
20	259	07	259	02	258	57	258	52	258	47	258	41	258	36	258	30	258	25	258	20
21	260	12	260	08	260	03	259	59	259	54	259	49	259	44	259	39	259	34	259	30
22	261	17	261	13	261	09	261	05	261	01	260	56	260	52	260	48	260	43	260	40
23	262	22	262	18	262	15	262	11	262	08	262	04	262	00	261	57	261	52	261	50
24	263	28	263	24	263	21	263	18	263	15	263	12	263	09	263	06	263	02	263	00
25	264	33	264	30	264	27	264	25	264	22	264	20	264	17	264	15	264	11	264	10
26	265	38	265	36	265	33	265	32	265	29	265	28	265	26	265	24	265	21	265	20
27	266	44	266	42	266	40	266	39	266	37	266	36	266	34	266	33	266	31	266	30
28	267	49	267	48	267	46	267	46	267	44	267	44	267	43	267	42	267	40	267	40
29	268	55	268	54	268	53	268	53	268	52	268	52	268	5	268	51	268	50	268	50
30	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00

Tables of Right Ascension.

North Latitude.

	0		1		2		3		4		5		6		7		8		9	
♑	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00
1	271	05	271	05	271	05	271	04	271	04	271	03	271	03	271	02	271	02	271	01
2	272	11	72	10	272	10	272	08	272	08	272	06	272	06	272	04	272	04	272	03
3	273	16	273	15	273	14	273	12	273	11	273	09	273	08	273	06	273	05	273	04
4	274	22	274	20	274	19	274	16	274	15	274	12	274	11	274	08	274	07	274	06
5	275	27	275	25	275	23	275	20	275	18	275	15	275	13	275	10	275	09	275	07
6	276	32	276	30	276	27	276	24	276	21	276	18	276	15	276	12	276	10	276	08
7	277	38	277	35	277	31	277	28	277	25	277	21	277	18	277	14	277	12	277	10
8	278	43	73	39	278	35	278	32	278	28	278	24	278	20	278	16	278	13	278	11
9	279	48	279	43	279	39	279	35	279	31	279	26	279	22	279	18	279	14	279	12
10	280	53	280	48	280	43	280	39	280	34	280	29	280	25	280	20	280	16	280	13
11	281	58	281	53	281	47	281	42	281	37	281	32	281	27	281	22	281	17	281	14
12	283	03	282	57	282	51	282	45	282	40	282	34	282	29	282	23	282	19	282	15
13	284	08	284	02	283	55	283	49	283	43	283	37	283	31	283	25	283	20	283	15
14	285	13	285	06	284	59	284	53	284	46	284	40	284	33	284	27	284	21	284	16
15	286	17	286	10	286	03	285	56	285	49	285	42	285	35	285	28	285	22	285	16
16	287	22	287	14	287	07	286	59	286	52	286	45	286	37	286	30	286	23	286	16
17	288	26	288	18	288	11	288	02	287	55	287	47	287	39	287	32	287	24	287	17
18	289	31	289	22	289	14	289	05	288	57	288	49	288	41	288	33	288	25	288	17
19	290	35	290	26	290	17	290	08	290	00	289	51	289	43	289	34	289	26	289	17
20	291	39	291	30	291	20	291	11	291	02	290	53	290	44	290	35	290	27	290	17
21	292	43	292	33	292	23	292	13	292	04	291	55	291	45	291	36	291	28	291	17
22	293	47	293	37	293	26	293	16	293	06	292	56	292	47	292	37	292	28	292	17
23	294	51	294	40	294	29	294	19	294	08	293	58	293	48	293	38	293	28	293	17
24	295	54	95	43	295	32	295	21	95	10	294	59	294	49	294	38	294	28	294	17
25	296	57	296	46	96	35	296	23	296	12	296	01	295	50	295	39	295	28	295	17
26	298	01	297	49	97	37	297	25	297	14	297	02	296	51	296	39	296	28	296	17
27	299	04	298	51	98	39	298	27	298	15	298	03	297	51	297	39	97	28	297	16
28	300	07	299	54	299	41	299	29	99	16	299	04	298	52	298	40	298	28	298	16
29	301	09	300	56	300	43	300	30	300	17	300	05	299	53	299	40	299	28	99	16
30	02	12	301	58	301	45	301	31	301	18	301	05	300	53	300	40	300	28	300	16

Tables of Right Ascension.

South Latitude.

	0		1		2		3		4		5		6		7		8		9	
♑	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00	270	00
1	271	05	271	06	271	07	271	07	271	08	271	08	271	09	271	09	271	10	271	10
2	272	11	272	12	272	14	272	15	272	16	272	16	272	18	272	18	272	20	272	20
3	273	16	273	18	273	20	273	23	273	23	273	24	273	26	273	27	273	29	273	30
4	274	22	274	24	274	26	264	31	274	31	274	32	274	34	274	36	274	39	274	40
5	275	27	275	30	275	33	275	38	275	38	275	40	275	43	275	45	275	48	275	50
6	276	32	276	36	276	39	276	45	276	45	276	48	276	51	276	54	276	58	277	00
7	277	38	277	41	277	45	277	52	277	52	277	56	278	00	278	03	278	07	278	10
8	278	43	278	47	278	51	278	59	278	59	279	04	279	08	279	12	279	17	279	20
9	279	48	279	52	279	57	280	06	280	06	280	11	280	16	280	21	280	26	280	30
10	280	53	280	58	281	03	281	13	281	13	281	19	281	24	281	30	281	35	281	40
11	281	58	282	04	282	09	282	20	282	20	282	26	282	32	282	38	282	44	282	50
12	283	03	283	09	283	15	283	27	283	27	283	33	283	40	283	46	283	53	283	59
13	284	08	284	14	284	21	284	34	284	34	284	41	284	48	284	55	285	02	285	09
14	285	13	285	19	285	27	285	41	285	41	285	48	285	56	286	03	286	11	286	19
15	286	17	286	24	286	32	286	47	286	47	286	55	287	03	287	11	287	19	287	28
16	287	22	287	29	287	38	287	54	287	54	288	02	288	11	288	19	288	28	288	37
17	288	26	288	34	288	43	289	00	289	00	289	09	289	18	289	27	289	36	289	45
18	289	31	289	39	289	48	290	06	290	06	290	15	290	25	290	34	290	44	290	54
19	290	35	290	44	290	53	291	12	291	12	291	22	291	32	291	42	291	52	292	02
20	291	39	291	49	291	58	292	18	292	18	292	29	292	39	292	50	293	00	293	11
21	292	43	292	53	293	03	293	24	293	24	293	35	293	46	293	57	294	08	294	19
22	293	47	293	57	294	08	294	30	294	30	294	41	294	52	295	04	295	15	295	27
23	294	51	295	01	295	13	295	35	295	35	295	47	295	58	296	10	296	22	296	35
24	295	54	296	05	296	17	296	40	296	40	296	53	297	04	297	16	297	29	297	42
25	296	57	297	09	297	21	297	45	297	45	297	58	298	10	298	23	298	36	298	50
26	298	01	298	13	298	25	298	50	298	50	299	03	299	16	299	29	299	43	299	57
27	299	04	299	16	299	29	299	55	299	55	300	08	300	22	300	35	300	49	301	04
28	300	07	300	19	300	35	300	59	300	59	301	13	301	27	301	41	301	55	302	10
29	301	09	301	22	301	36	301	03	302	03	302	18	302	32	302	47	303	01	303	16
30	302	12	302	25	302	39	302	07	303	07	303	22	303	37	303	52	304	07	304	22

Tables of Right Ascension.

North Latitude.

	0		1		2		3		4		5		6		7		8		9	
♒	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	302	12	301	58	301	45	301	31	301	18	301	05	300	53	300	40	300	28	300	16
1	303	14	303	0[illegible]	302	47	302	33	302	19	302	06	301	53	301	40	301	28	301	15
2	304	16	304	02	303	48	303	34	303	20	303	06	302	53	302	40	302	27	302	14
3	305	18	305	03	304	50	304	35	304	21	304	07	303	53	303	39	303	26	303	13
4	306	20	306	05	305	51	305	36	305	22	305	07	304	53	304	39	304	25	304	12
5	307	22	307	07	306	52	306	36	306	22	306	07	305	52	305	38	305	24	305	10
6	308	24	308	08	307	53	307	37	307	22	307	07	306	52	306	37	306	23	305	09
7	309	25	309	09	308	54	308	37	308	22	308	07	307	51	307	36	307	22	307	07
8	310	26	310	10	309	54	309	37	309	22	309	06	308	50	308	35	308	20	308	05
9	311	2[illegible]	311	10	310	54	310	37	310	21	310	05	309	49	309	33	309	18	309	03
10	312	28	312	11	311	54	311	37	311	21	311	04	310	48	310	3[illegible]	310	17	310	01
11	313	28	313	11	312	54	312	37	312	20	312	03	311	47	311	31	311	15	310	59
12	314	29	314	11	313	54	313	37	313	19	313	02	312	46	312	29	312	13	311	57
13	315	29	315	11	314	54	314	36	314	18	314	01	313	45	313	27	313	11	312	54
14	316	29	316	11	315	53	315	35	315	17	315	00	314	43	314	25	314	09	313	52
15	317	29	317	10	316	52	316	34	316	16	315	58	315	41	315	23	315	06	314	50
16	318	29	318	10	317	51	317	33	317	15	316	57	316	39	316	21	316	04	315	47
17	319	28	319	09	318	50	318	32	318	14	317	55	317	37	317	19	317	02	316	44
18	320	27	320	08	319	49	319	30	319	12	318	53	318	35	318	17	317	59	317	41
19	321	27	321	07	320	4[illegible]	320	29	320	10	319	51	319	33	319	15	318	56	318	38
20	322	26	322	06	321	47	321	27	321	08	320	49	320	31	320	12	319	53	319	35
21	323	25	323	04	322	45	322	25	322	06	321	47	321	28	321	09	320	50	320	31
22	324	23	324	03	323	43	323	23	323	04	322	45	322	25	322	06	321	47	321	28
23	325	22	325	01	324	41	324	21	324	01	323	42	323	22	323	03	322	44	322	24
24	326	20	325	59	325	39	325	19	324	59	324	39	324	19	323	59	323	40	323	21
25	327	18	326	57	326	37	326	17	325	56	325	36	325	1	324	56	324	37	324	17
26	328	16	327	55	327	35	327	14	326	53	326	33	326	13	325	53	325	33	325	13
27	329	14	328	53	328	32	328	11	327	50	327	30	327	10	326	49	326	29	326	09
28	330	11	329	50	329	29	329	08	328	47	328	27	328	06	327	46	327	25	327	05
29	331	09	330	47	330	26	330	05	329	44	329	23	329	03	328	42	328	21	328	01
30	332	06	331	44	331	23	331	02	330	41	330	20	329	59	329	38	329	17	328	56

Tables of Right Ascension.

South Latitude.

	0		1		2		3		4		5		6		7		8		9	
♒	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	302	12	302	25	302	3[illegible]	302	53	303	07	303	22	303	37	303	52	304	07	304	22
1	303	14	303	28	303	42	303	57	304	11	304	26	304	42	304	57	305	12	305	28
2	304	16	304	31	304	45	305	00	305	15	305	30	305	46	306	02	306	17	306	33
3	305	18	305	33	305	48	306	03	306	18	306	34	306	50	307	07	307	22	307	38
4	306	20	306	36	306	51	307	06	307	22	307	38	307	54	308	11	308	27	308	43
5	307	22	307	38	307	54	308	09	308	25	308	42	308	54	309	15	309	32	309	4[illegible]
6	308	24	308	40	308	56	309	12	309	28	309	45	310	02	310	19	310	36	310	53
7	309	25	309	42	309	58	310	14	310	31	310	48	311	05	311	23	311	40	311	5[illegible]
8	310	26	310	43	311	00	311	16	311	33	311	51	312	08	312	26	312	44	313	01
9	311	27	311	44	312	01	312	18	312	35	312	53	313	11	313	29	313	47	314	05
10	312	28	312	45	313	02	313	20	313	37	313	55	314	14	314	32	314	5[illegible]	315	08
11	313	28	313	46	314	03	314	21	314	39	314	57	315	16	315	35	315	53	316	11
12	314	29	314	46	315	04	315	22	315	40	315	59	316	18	316	37	316	56	317	14
13	315	29	315	47	316	05	316	23	316	41	317	00	317	20	317	39	317	58	318	17
14	316	29	316	47	317	06	317	24	317	42	318	01	318	21	318	41	319	00	319	19
15	317	29	317	47	318	06	318	24	318	43	319	02	319	22	319	42	320	02	320	22
16	318	29	318	47	319	06	319	25	319	44	320	03	320	24	320	44	321	04	321	24
17	319	28	319	47	320	06	320	25	320	45	321	04	321	25	321	45	322	06	322	26
18	320	2[illegible]	320	46	321	06	321	25	321	45	322	05	322	26	322	46	323	07	323	2[illegible]
19	321	27	321	46	322	06	322	25	322	45	323	06	323	27	323	47	324	08	324	2[illegible]
20	322	2[illegible]	322	45	323	04	323	25	323	45	324	06	324	27	324	48	325	09	325	3[illegible]
21	323	2[illegible]	323	44	324	05	324	24	324	45	325	06	325	27	325	48	326	0[illegible]	326	3[illegible]
22	324	23	324	43	325	03	325	24	325	45	326	06	326	27	326	48	327	10	327	31
23	325	22	325	42	326	02	326	23	326	44	327	05	327	27	327	4[illegible]	328	10	328	31
24	326	2[illegible]	326	46	327	00	327	22	327	43	328	04	328	26	328	48	329	1[illegible]	329	3[illegible]
25	327	1[illegible]	327	39	328	01	328	21	328	42	329	03	329	25	329	47	330	1[illegible]	330	3[illegible]
26	328	1[illegible]	328	37	328	58	329	19	329	41	330	02	330	24	330	46	331	0[illegible]	331	3[illegible]
27	329	14	329	3[illegible]	329	56	330	17	330	39	331	0[illegible]	331	23	331	45	332	0[illegible]	332	3[illegible]
28	330	11	330	33	330	54	331	15	331	37	331	59	332	22	332	44	333	07	333	29
29	331	09	331	30	331	52	332	13	332	35	332	57	333	20	333	43	334	06	334	28
30	332	06	332	2[illegible]	332	49	333	11	333	33	333	55	334	18	334	[illegible]	335	0[illegible]	335	[illegible]

Tables of Right Ascension.

North Latitude.

	0		1		2		3		4		5		6		7		8		9	
♓	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	332	06	331	44	331	23	331	02	330	41	330	20	329	59	329	38	329	17	328	56
1	333	04	332	41	332	20	331	59	331	38	331	16	330	55	330	34	330	13	329	52
2	334	01	333	38	333	17	332	55	332	34	332	12	331	51	331	30	331	09	330	47
3	334	58	334	35	334	13	333	51	333	30	333	08	332	47	332	25	332	04	331	42
4	335	55	335	32	335	10	334	48	334	26	334	04	333	43	333	21	333	00	332	37
5	336	51	336	29	336	07	335	44	335	22	335	00	334	39	334	17	333	55	333	32
6	337	48	337	25	337	03	336	40	336	18	335	56	335	34	335	12	334	50	334	27
7	338	44	338	22	337	59	337	36	337	14	336	52	336	30	336	08	335	46	335	22
8	339	40	339	18	338	55	338	32	338	10	337	48	337	26	337	03	336	41	336	17
9	340	37	340	14	339	51	339	28	339	06	338	43	338	21	337	58	337	36	337	12
10	341	33	341	10	340	47	340	24	340	02	339	39	339	17	338	54	338	31	338	07
11	342	29	342	06	341	43	341	20	340	58	340	35	340	12	339	49	339	26	339	02
12	343	25	343	02	342	39	342	16	341	53	341	30	341	07	340	44	340	21	339	57
13	344	20	343	58	343	35	343	12	342	49	342	25	342	02	341	39	341	16	340	52
14	345	16	344	53	344	30	344	07	343	44	343	20	342	57	342	34	342	11	341	48
15	346	12	345	48	345	25	345	02	344	39	344	15	343	52	343	29	343	06	342	43
16	347	07	346	44	346	21	345	57	345	34	345	10	344	47	344	24	344	01	343	38
17	348	03	347	40	347	17	346	52	346	29	346	05	345	42	345	19	344	56	344	33
18	348	58	348	35	348	12	347	47	347	24	347	00	346	37	346	13	345	51	345	28
19	349	54	349	31	349	07	348	43	348	19	347	55	347	32	347	08	346	46	346	23
20	350	49	350	26	350	02	349	38	349	14	348	50	348	27	348	03	347	41	347	19
21	351	44	351	21	350	57	350	33	350	09	349	45	349	22	348	58	348	36	348	14
22	352	39	352	16	351	52	351	28	351	04	350	40	350	17	349	53	349	30	349	09
23	353	35	353	11	352	47	352	23	351	59	351	35	351	12	350	4[illegible]	350	25	350	04
24	354	30	354	06	353	42	353	18	352	54	352	30	352	07	351	43	351	20	350	59
25	355	25	355	01	354	3[illegible]	354	14	353	50	353	26	353	02	352	38	352	15	351	53
26	356	20	355	57	355	33	355	09	354	45	354	21	353	57	353	33	353	10	352	49
27	357	15	356	52	356	28	356	04	355	40	355	16	354	52	354	28	354	04	353	42
28	358	10	357	47	357	23	356	59	356	35	356	11	355	47	355	23	354	59	354	36
29	359	05	358	42	358	18	357	54	357	30	357	06	356	42	356	18	355	54	355	30
30	360	00	359	37	359	13	358	49	358	25	358	01	357	37	357	13	356	5[illegible]	356	24

Tables of Right Ascension.

South Latitude.

	0		1		2		3		4		5		6		7		8		9	
♓	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
0	332	06	332	28	332	49	333	11	333	33	333	55	334	18	334	41	335	04	335	27
1	333	04	333	25	333	47	334	09	334	31	334	53	335	16	335	39	336	03	336	26
2	334	01	334	22	334	44	335	06	335	29	335	51	336	14	336	37	337	01	337	25
3	334	58	335	19	335	41	336	03	336	26	336	49	337	12	337	35	337	59	338	23
4	335	55	336	16	336	39	337	01	337	24	337	47	338	10	338	32	338	57	339	21
5	336	51	337	13	337	36	337	58	338	21	338	44	339	08	339	31	339	55	340	18
6	337	48	338	10	338	33	338	55	339	18	339	41	340	05	340	28	340	52	341	16
7	338	44	339	07	339	30	339	52	340	15	340	38	341	02	341	25	341	4[illegible]	342	13
8	339	40	340	04	340	27	340	49	341	12	341	35	341	59	342	22	342	46	343	10
9	340	37	341	00	341	23	341	46	342	09	342	32	342	56	343	1[illegible]	343	43	344	07
10	341	33	341	56	342	19	342	42	343	06	343	29	343	53	344	16	344	40	345	04
11	342	29	342	52	343	15	343	38	344	02	344	25	344	49	345	13	345	37	346	01
12	343	25	343	48	344	11	344	34	344	58	345	21	345	45	346	0[illegible]	346	33	346	58
13	344	20	344	44	345	07	345	30	345	54	346	18	346	42	347	06	347	30	347	54
14	345	16	345	40	346	03	346	26	346	50	347	14	347	38	348	02	348	26	348	50
15	346	12	346	35	346	59	347	22	347	46	348	10	348	34	348	58	349	22	349	46
16	347	07	347	31	347	55	348	18	348	42	349	06	349	30	349	54	350	18	350	42
17	348	03	348	27	348	51	349	14	349	38	350	02	350	26	350	5[illegible]	351	14	351	38
18	348	58	349	22	349	46	350	09	350	33	350	57	351	21	351	45	352	09	352	33
19	349	54	350	18	350	42	351	05	351	29	351	53	352	17	352	41	353	05	353	29
20	350	49	351	13	351	37	352	01	352	25	352	49	353	13	353	37	354	01	354	24
21	351	44	352	08	352	32	352	56	353	20	353	44	354	08	354	32	354	56	355	20
22	352	39	353	03	353	27	353	51	354	15	354	3[illegible]	355	03	355	27	355	51	356	15
23	353	35	353	58	354	22	354	46	355	10	355	34	355	58	356	22	356	46	357	10
24	354	30	354	53	355	17	355	41	356	05	356	29	356	53	357	17	357	41	358	06
25	355	25	355	48	356	12	356	36	357	00	357	24	357	4[illegible]	358	12	358	36	359	01
26	356	20	356	43	357	07	357	31	357	55	358	19	358	43	359	07	359	31	359	56
27	357	15	357	38	358	02	358	26	358	50	359	14	359	3[illegible]	0	02	0	26	0	52
28	358	10	358	33	358	57	359	21	359	45	0	09	0	3[illegible]	0	57	1	22	1	47
29	359	05	359	28	359	52	0	16	0	40	1	04	1	28	1	52	2	17	2	42
30	360	00	0	23	0	47	0	11	1	35	1	59	1	23	2	47	3	12	3	37

Tables of the Amplitudes, Ortive and Occasive.

Degrees of the Declination.	Elevation of the Pole. 1 D.	1 M.	2 D.	2 M.	3 D.	3 M.	4 D.	4 M.	5 D.	5 M.	6 D.	6 M.	7 D.	7 M.	8 D.	8 M.	9 D.	9 M.
1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
2	2	0	2	0	2	0	2	0	2	0	2	0	2	1	2	1	2	1
3	3	0	3	0	3	0	3	0	3	0	3	1	3	1	3	1	3	1
4	4	0	4	0	4	0	4	1	4	1	4	2	4	2	4	4	4	5
5	5	0	5	0	5	0	5	1	5	1	5	2	5	2	5	5	5	5
6	6	0	6	0	6	0	6	1	6	2	6	3	6	3	6	5	6	5
7	7	0	7	0	7	0	7	1	7	2	7	3	7	3	7	5	7	5
8	8	0	8	0	8	0	8	1	8	2	8	3	8	4	8	5	8	6
9	9	0	9	0	9	0	9	1	9	2	9	3	9	4	9	5	9	6
10	10	0	10	0	10	0	10	1	10	2	10	3	10	4	10	6	10	7
11	11	0	11	0	11	0	11	1	11	2	11	3	11	4	11	6	11	7
12	12	0	12	0	12	0	12	1	12	2	12	4	12	5	12	7	12	9
13	13	0	13	0	13	0	13	1	13	3	13	5	13	5	13	7	13	9
14	14	0	14	0	14	1	14	2	14	3	14	5	14	7	14	9	14	11
15	15	0	15	0	15	1	15	2	15	3	15	5	15	7	15	9	15	11
16	16	0	16	1	16	2	16	3	16	4	16	6	16	9	16	10	16	12
17	17	0	17	1	17	2	17	3	17	4	17	6	17	8	17	10	17	13
18	18	0	18	1	18	2	18	3	18	4	18	6	18	8	18	11	18	14
19	19	0	19	1	19	2	19	3	19	4	19	6	19	9	19	12	19	15
20	20	0	20	1	20	2	20	3	20	4	20	7	20	9	20	12	20	15
21	21	0	21	1	21	2	21	3	21	5	21	7	21	10	21	13	21	16
22	22	0	22	1	22	2	22	4	22	5	22	8	22	10	22	13	22	17
23	23	0	23	1	23	2	23	4	23	6	23	9	23	10	23	15	23	18
24	24	0	24	2	24	3	24	5	24	6	24	9	24	13	24	16	24	20
25	25	0	25	2	25	4	25	5	25	6	25	10	25	14	25	17	25	21
26	26	1	26	2	26	5	26	6	26	7	26	11	26	15	26	18	26	22
27	27	1	27	3	27	5	27	6	27	7	27	11	27	15	27	19	27	19
28	28	1	28	3	28	5	28	6	28	7	28	11	28	16	28	20	28	24
29	29	1	29	3	29	5	29	6	29	7	29	12	29	16	29	20	29	24
30	30	1	30	3	30	5	30	6	30	8	30	12	30	17	30	21	30	25
31	31	1	31	3	31	5	31	7	31	8	31	12	31	17	31	22	31	27
32	32	1	32	3	32	5	32	7	32	8	32	13	32	18	32	23	32	28
33	33	0	33	2	33	4	33	7	33	8	33	13	33	18	33	23	33	29
34	34	1	34	2	34	4	34	7	34	8	34	13	34	18	34	24	34	30
35	35	0	35	1	35	4	35	7	35	9	35	14	35	19	35	24	35	30
36	36	0	36	1	36	3	36	7	36	09	36	14	36	19	36	25	36	[illegible]
37	37	0	37	1	37	3	37	7	37	10	37	14	37	20	37	26	37	32
38	38	0	38	1	38	3	38	7	38	10	38	15	38	21	38	27	38	34
39	39	0	39	2	39	4	39	7	39	11	39	15	39	22	39	28	39	35
40	40	0	40	2	40	4	40	7	40	11	40	16	40	22	40	29	40	36

Tables of the Amplitudes, Ortive and Occasive.

Degrees of the Declination.	Elevation of the Pole. 10 D.	10 M.	11 D.	11 M.	12 D.	12 M.	13 D.	13 M.	14 D.	14 M.	15 D.	15 M.	16 D.	16 M.	17 D.	17 M.	18 D.	18 M.	19 D.	19 M.
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	3	1	03
2	2	2	2	2	2	2	2	2	2	2	2	3	2	4	2	4	2	5	2	06
3	3	2	3	4	3	3	3	4	3	4	3	5	3	5	3	7	3	8	3	09
4	4	3	4	6	4	7	4	8	4	9	4	10	4	11	4	13	4	14	4	15
5	5	4	5	6	5	7	5	8	5	10	5	11	5	12	5	14	5	16	5	17
6	6	5	6	7	6	9	6	11	6	13	6	15	6	14	6	17	6	19	6	21
7	7	6	7	7	7	9	7	11	7	13	7	15	7	16	7	18	7	21	7	24
8	8	7	8	8	8	9	8	11	8	13	8	15	8	17	8	20	8	24	8	27
9	9	7	9	8	9	9	9	12	9	14	9	17	9	20	9	23	9	26	9	30
10	10	8	10	10	10	12	10	15	10	18	10	21	10	24	10	27	10	31	10	35
11	11	9	11	11	11	13	11	15	11	17	11	23	11	27	11	27	11	31	11	38
12	12	11	12	13	12	16	12	19	12	22	12	26	12	30	12	34	12	38	12	42
13	13	12	13	15	13	18	13	20	13	26	13	28	13	32	13	36	13	41	13	46
14	14	13	14	16	14	19	14	22	14	26	14	30	14	35	14	40	14	45	14	50
15	15	14	15	17	15	20	15	24	15	28	15	32	15	37	15	42	15	48	15	54
16	16	15	16	18	16	22	16	26	16	30	16	[illegible]	16	40	16	45	16	52	16	58
17	17	16	17	20	17	24	17	28	17	32	17	37	17	42	17	48	17	54	18	00
18	18	17	18	21	18	25	18	30	18	35	18	40	18	46	18	52	18	58	19	05
19	19	18	19	22	19	27	19	32	19	37	19	42	19	47	19	55	20	00	20	08
20	20	19	20	23	20	28	20	33	20	38	20	42	20	50	20	57	21	04	21	12
21	21	20	21	24	21	29	21	34	21	40	21	46	21	54	22	02	22	10	22	19
22	22	21	22	26	22	31	22	36	22	42	22	49	22	56	23	03	23	11	23	20
23	23	22	23	26	23	33	23	37	23	44	23	53	23	58	24	06	24	13	24	24
24	24	24	24	30	24	36	24	42	24	48	24	54	25	03	25	11	25	22	25	31
25	25	25	25	31	25	37	25	44	25	50	25	57	26	06	26	14	26	24	26	33
26	26	26	26	32	26	39	26	46	26	53	27	00	27	09	27	18	27	28	27	38
27	27	27	27	33	27	40	27	48	27	55	28	03	28	12	28	23	28	33	28	43
28	28	28	28	35	28	42	28	50	28	57	29	06	29	15	29	26	29	34	29	44
29	29	29	29	37	29	45	29	53	30	00	30	08	30	28	30	29	30	39	30	51
30	30	31	30	39	30	47	30	55	31	03	31	11	31	22	31	37	31	45	31	56
31	31	32	31	40	31	50	31	59	32	07	32	14	32	25	32	37	32	49	33	01
32	32	33	32	41	32	51	33	00	33	08	33	17	33	28	33	41	33	54	34	07
33	33	34	33	42	33	52	34	03	34	11	34	20	34	31	34	44	34	58	35	12
34	34	36	34	44	34	53	35	04	35	14	35	24	35	34	35	47	36	02	36	17
35	35	37	35	45	35	55	36	05	36	16	36	27	36	37	36	51	37	06	37	21
36	36	39	36	47	36	56	37	06	37	18	37	29	37	41	37	56	38	10	38	26
37	37	40	37	49	38	00	38	08	38	20	38	32	38	45	39	02	39	15	39	32
38	38	42	38	51	39	02	39	11	39	23	39	37	39	51	40	05	40	20	40	38
39	39	44	39	52	40	04	40	15	40	26	40	40	40	55	41	09	41	25	41	44
40	40	45	40	54	41	05	41	17	41	29	41	43	41	58	42	14	42	31	42	50

Tables of the Amplitudes, Ortive and Occasive.

Elevation of the Pole.

Degrees of the Declination.	20		21		22		23		24		25		26		27		28		29	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	1	04	1	04	1	05	1	05	1	06	1	06	1	07	1	07	1	08	1	08
2	2	07	2	07	2	08	2	09	2	10	2	11	2	12	2	13	2	15	2	16
3	3	10	3	11	3	13	3	14	3	15	3	17	3	19	3	21	3	22	3	24
4	4	17	4	19	4	21	4	23	4	25	4	27	4	29	4	31	4	34	4	36
5	5	19	5	21	5	23	5	26	5	28	5	31	5	33	5	36	5	39	5	43
6	6	24	6	26	6	29	6	32	6	35	6	38	6	41	6	45	6	48	6	52
7	7	26	7	29	7	32	7	36	7	40	7	44	7	48	7	52	7	56	8	00
8	8	31	8	34	8	38	8	42	8	46	8	50	8	55	9	00	9	05	9	10
9	9	35	9	39	9	43	9	47	9	51	9	56	10	01	10	06	10	12	10	18
10	10	38	10	43	10	48	10	53	10	58	11	03	11	09	11	15	11	21	11	27
11	11	39	11	43	11	48	11	53	12	00	12	08	12	16	12	23	12	30	12	37
12	12	47	12	52	12	57	13	03	13	09	13	16	13	23	13	30	13	37	13	44
13	13	51	13	57	14	03	14	09	14	15	14	22	14	29	14	33	14	45	14	53
14	14	55	15	01	14	08	15	15	15	22	15	29	15	37	15	46	15	55	16	04
15	16	00	16	07	16	14	16	21	16	28	16	35	16	44	16	53	17	03	17	13
16	17	03	17	10	17	17	17	25	17	33	17	4[illegible]	17	51	18	00	18	10	18	21
17	18	07	18	15	18	21	18	31	18	40	18	49	18	59	19	10	19	21	19	32
18	19	12	19	20	19	29	19	38	19	47	19	56	20	07	20	18	20	29	20	41
19	20	16	20	24	20	33	20	43	20	53	21	03	21	14	21	26	21	38	21	51
20	21	21	21	3[illegible]	21	39	21	49	21	59	22	10	22	22	22	34	22	47	23	01
21	22	28	22	37	22	46	22	56	23	06	23	17	23	28	23	41	23	55	24	10
22	23	30	23	40	23	50	24	01	24	13	24	25	24	38	24	52	25	07	25	22
23	24	34	24	46	24	56	25	08	25	21	25	35	25	49	26	03	26	18	26	33
24	25	38	25	50	26	01	26	13	26	27	26	40	26	56	27	12	27	28	27	44
25	26	43	26	55	27	07	27	19	27	34	27	27	28	04	28	21	28	39	28	57
26	27	48	28	00	28	14	28	26	28	43	28	55	29	15	29	33	29	5[illegible]	30	07
27	28	53	29	06	29	20	29	32	29	50	30	04	30	22	30	41	31	00	31	18
28	29	58	30	12	30	27	30	40	30	57	31	12	31	31	31	50	32	09	[illegible]	29
29	31	03	31	18	31	34	31	48	32	04	32	20	32	4[illegible]	33	01	33	21	33	42
30	32	08	32	24	32	40	32	56	33	12	33	29	33	49	34	1[illegible]	34	22	34	44
31	33	14	33	3[illegible]	33	46	34	03	34	20	34	38	35	00	35	22	35	45	36	07
32	34	2[illegible]	34	36	34	52	35	11	35	28	35	4[illegible]	36	04	36	28	36	53	37	18
33	35	26	35	42	35	59	36	18	36	36	36	51	37	15	37	40	38	[illegible]	38	31
34	36	3[illegible]	36	48	37	06	37	26	37	45	58	03	38	27	38	52	39	18	39	45
35	37	3[illegible]	37	55	38	13	38	33	38	54	59	15	39	38	40	04	40	3[illegible]	40	59
36	38	45	39	01	39	20	39	41	40	03	40	26	40	5[illegible]	41	16	41	4[illegible]	42	13
37	39	49	40	08	40	28	40	50	41	13	41	37	42	07	42	30	42	59	43	36
38	40	5[illegible]	41	15	41	37	41	59	42	23	42	48	43	2[illegible]	43	45	44	07	44	59
39	42	03	42	23	42	45	43	08	43	33	43	59	44	4[illegible]	45	00	45	27	46	21
40	43	10	43	31	43	54	44	17	44	43	45	10	45	58	46	14	46	46	47	43

Tables of the Amplitudes, Ortive and Occasive.

Elevation of the Pole.

Degrees of the Declination.	30		31		32		33		34		35		36		37		38		39	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	1	09	1	10	1	11	1	12	1	12	1	13	1	14	1	15	1	16	1	17
2	2	17	2	19	2	21	2	23	2	25	2	26	2	28	2	30	2	32	2	34
3	3	26	3	29	3	31	3	34	3	37	3	40	3	43	3	45	3	48	3	51
4	4	39	4	41	4	44	4	48	4	52	4	55	4	57	5	00	5	04	5	08
5	5	46	5	50	5	54	5	58	6	02	6	06	6	11	6	16	6	21	6	26
6	6	57	7	01	7	06	7	11	7	15	7	20	7	25	7	31	7	37	7	44
7	8	05	8	10	8	15	8	20	8	25	8	32	8	40	8	47	8	54	9	01
8	9	15	9	21	9	27	9	33	9	40	9	47	9	54	10	02	10	10	10	19
9	10	24	10	31	10	38	10	45	10	53	11	01	11	09	11	18	11	27	11	37
10	11	34	11	42	11	50	11	58	12	06	12	17	12	24	12	33	12	43	12	54
11	12	44	12	51	12	59	13	08	13	17	13	27	13	38	13	49	14	01	14	13
12	14	53	14	02	14	12	14	22	14	32	14	42	14	53	15	05	15	18	15	31
13	15	02	15	11	15	22	15	33	15	44	15	56	16	04	16	22	16	35	16	49
14	16	13	16	24	16	35	16	46	16	58	17	11	17	24	17	38	17	53	18	08
15	17	23	17	34	17	46	17	59	18	11	18	25	18	40	18	55	19	10	19	27
16	18	33	18	45	18	58	19	11	19	25	19	40	19	55	20	11	20	28	20	40
17	19	44	19	57	20	10	20	24	20	39	20	55	21	11	21	28	21	46	22	00
18	20	54	21	08	21	22	21	37	21	53	22	10	22	27	22	48	22	05	23	26
19	22	05	22	19	22	34	22	50	23	07	23	25	23	44	24	03	24	24	24	46
20	23	16	23	31	23	47	24	04	24	22	24	41	25	00	25	21	25	43	26	06
21	24	25	24	41	25	01	25	19	25	37	25	57	26	18	26	39	27	03	27	27
22	25	38	25	55	26	13	26	32	26	52	27	13	27	35	27	58	28	23	28	49
23	26	49	27	07	27	26	27	46	28	07	28	29	28	53	29	17	29	43	30	11
24	28	01	28	20	28	39	29	01	29	23	29	46	30	11	30	37	31	06	31	35
25	29	13	29	32	29	54	30	16	30	39	31	04	31	30	31	57	32	27	32	58
26	30	25	30	46	31	08	31	31	31	55	32	21	32	48	33	17	33	48	34	21
27	31	37	31	58	32	22	32	47	33	12	33	39	34	08	34	17	34	57	35	38
28	32	50	33	13	33	37	34	03	34	30	34	58	35	28	36	00	36	33	37	06
29	34	03	34	27	34	52	35	19	35	47	36	18	36	49	37	2[illegible]	38	01	38	38
30	35	16	35	41	36	08	36	36	37	05	37	38	38	10	38	4[illegible]	39	26	40	05
31	36	30	36	56	37	24	37	53	38	24	38	57	39	32	40	09	40	53	41	37
32	37	43	38	11	38	40	39	12	39	44	40	19	40	55	41	34	42	18	43	02
33	38	58	39	29	39	58	40	30	41	05	41	42	42	20	43	04	43	5[illegible]	44	37
34	40	13	40	47	41	16	41	49	42	26	43	05	43	45	44	34	45	26	46	12
35	41	29	42	05	42	34	43	09	43	47	44	28	45	10	46	04	47	00	47	48
36	42	44	43	23	43	52	44	39	45	09	45	51	46	36	47	33	48	34	49	24
37	43	59	44	41	45	10	45	51	46	34	47	19	48	06	49	03	50	08	51	00
38	45	15	45	59	46	29	47	14	47	59	48	47	49	36	50	33	51	42	52	36
39	46	30	47	17	47	58	48	37	49	24	50	15	51	06	52	04	53	16	54	12
40	47	55	48	35	49	17	50	12	50	50	51	42	52	37	53	36	54	50	55	48

Tables of the Amplitudes, Ortive and Occasive.

Degrees of the Declination.	Elevation of the Pole. 40 D.	40 M.	41 D.	41 M.	42 D.	42 M.	43 D.	43 M.	44 D.	44 M.	45 D.	45 M.	46 D.	46 M.	47 D.	47 M.	48 D.	48 M.	49 D.	49 M.
1	1	18	1	19	1	20	1	21	1	23	1	25	1	26	1	27	1	29	1	31
2	2	37	2	39	2	42	2	44	2	47	2	50	2	53	2	56	2	59	3	03
3	3	55	3	58	4	02	4	06	4	10	4	15	4	19	4	25	4	29	4	34
4	5	13	5	17	5	22	5	28	5	34	5	40	5	46	5	52	5	59	6	06
5	6	32	6	38	6	44	6	51	6	58	7	05	7	12	7	20	7	29	7	38
6	7	51	7	58	8	06	8	13	8	21	8	30	8	39	8	49	8	59	9	09
7	9	09	9	17	9	26	9	35	9	45	9	55	10	06	10	18	10	30	10	43
8	10	28	10	37	10	47	10	58	10	09	10	21	11	33	11	46	12	00	12	15
9	11	47	11	57	12	09	12	21	12	33	12	47	13	01	13	16	13	31	13	47
10	12	06	12	18	13	31	12	44	12	58	12	13	14	28	14	44	15	02	15	21
11	14	26	14	39	14	52	15	07	15	22	15	39	15	57	16	15	16	34	16	54
12	15	45	16	00	16	15	16	31	16	48	17	06	16	23	17	45	18	08	18	28
13	17	05	17	20	17	37	17	55	18	14	18	33	17	22	19	35	19	49	17	05
14	18	25	18	42	19	00	19	19	19	39	19	00	20	23	20	46	21	12	21	28
15	19	45	19	03	19	23	19	44	19	05	19	82	21	53	22	19	22	45	23	14
16	21	05	21	25	21	46	22	08	22	32	22	56	23	23	23	50	24	20	24	51
17	22	20	22	47	23	10	23	34	23	59	24	25	24	53	25	22	25	54	26	27
18	23	48	24	10	24	34	25	00	25	26	25	54	26	25	26	50	27	30	28	06
19	25	09	25	33	25	59	26	26	26	54	27	24	27	57	28	30	29	06	29	45
20	26	31	26	57	27	24	27	53	28	23	28	56	30	08	30	44	31	25	32	09
21	27	53	28	20	28	49	29	20	29	54	30	27	31	03	31	41	32	23	33	06
22	29	17	29	45	30	16	30	49	31	24	31	59	32	38	33	19	34	05	34	49
23	30	40	31	10	31	43	32	17	32	54	33	32	34	13	34	57	35	44	36	33
24	32	04	32	40	33	16	33	53	34	30	35	07	35	56	36	45	37	35	38	25
25	33	29	34	06	34	43	33	23	36	03	36	42	37	34	38	27	39	20	40	13
26	34	54	35	35	36	16	36	57	37	38	38	19	39	13	40	07	41	02	41	57
27	36	20	37	03	37	46	38	3[illegible]	39	13	39	57	40	52	41	57	42	57	43	57
28	37	48	38	35	39	20	40	06	40	50	41	36	42	39	43	43	44	47	45	51
29	39	16	40	04	40	52	41	40	42	28	43	17	44	25	45	33	46	41	47	49
30	40	45	41	36	42	27	43	18	44	09	45	00	46	12	44	24	48	36	49	50
31	42	14	43	08	44	02	44	56	45	51	46	46	48	04	49	21	50	39	51	57
32	43	47	44	40	45	37	46	28	47	30	48	33	49	57	51	21	52	45	54	09
33	45	17	46	04	46	32	48	10	49	15	50	24	51	46	53	12	54	43	56	25
34	46	53	47	48	48	48	49	52	51	01	52	16	53	36	55	04	56	41	58	41
35	48	29	49	21	50	32	51	40	52	55	54	15	55	42	57	18	59	04		
36	50	07	51	09	52	16	53	29	54	48	56	14	57	48	59	32				
37	51	47	52	54	54	06	55	24	56	55	58	08	59	54						
38	53	29	54	40	55	56	57	20	58	52	60	33								
39	55	15	56	31	57	54	59	05	61	09										
40	57	03	58	23	59	52	61	31												

Tables of the Amplitudes, Ortive and Occasive.

Degrees of the Declination.	Elevation of the Pole. 50 D.	50 M.	51 D.	51 M.	52 D.	52 M.	53 D.	53 M.	54 D.	54 M.	55 D.	55 M.	56 D.	56 M.	57 D.	57 M.	58 D.	58 M.	59 D.	59 M.	60 D.	60 M.
1	1	33	1	35	1	37	1	39	1	42	1	45	1	47	1	50	1	53	1	56	2	00
2	3	07	3	11	3	15	3	19	3	24	3	29	3	35	3	41	3	47	3	53	4	00
3	4	40	4	46	4	52	4	59	5	06	5	14	5	22	5	31	5	40	5	50	6	01
4	6	14	6	22	6	30	6	39	6	49	6	59	7	10	7	22	7	34	7	47	8	01
5	7	48	7	58	8	09	8	20	8	31	8	44	8	57	9	12	9	28	9	45	10	02
6	9	21	9	33	9	46	10	00	10	14	10	30	10	46	11	03	11	22	11	42	12	04
7	10	56	11	10	11	25	11	41	11	58	12	16	12	35	12	56	13	18	13	41	14	06
8	12	31	12	47	13	04	13	22	13	41	14	03	14	24	14	48	15	14	15	40	16	10
9	14	05	14	24	14	44	15	04	15	26	15	50	16	15	16	42	17	10	17	40	18	14
10	15	40	16	01	16	23	16	46	17	11	17	37	18	06	18	36	19	08	19	42	20	19
11	17	19	17	39	18	03	18	29	18	56	19	29	19	56	20	29	21	06	21	46	22	26
12	18	52	19	17	19	41	20	11	20	42	21	15	21	50	22	27	23	06	23	48	24	34
13	17	20	17	37	17	55	18	14	18	33	18	54	19	16	19	38	20	03	20	29	20	54
14	22	06	22	36	23	06	23	42	24	18	24	57	25	38	26	22	27	10	28	00	28	56
15	23	45	24	17	24	52	25	28	26	07	26	45	27	35	28	22	29	14	30	11	31	10
16	25	24	25	58	26	35	27	15	27	58	28	43	29	32	30	24	31	20	32	21	33	27
17	27	03	27	40	28	21	29	04	29	50	30	39	31	32	32	28	33	29	34	36	35	47
18	28	42	29	24	30	08	30	54	31	43	32	38	33	33	34	34	35	40	36	52	38	10
19	30	20	31	09	31	55	32	44	33	38	34	35	35	36	36	42	38	02	39	12	40	37
20	32	55	33	45	34	38	35	35	36	37	36	39	37	43	38	54	40	12	41	36	43	09
21	33	53	34	42	35	36	36	32	37	34	38	40	39	51	41	11	42	33	44	05	45	46
22	35	39	39	12	37	29	38	30	39	26	40	47	42	05	43	27	44	59	46	40	48	31
23	37	26	38	23	39	23	40	29	41	40	42	56	43	45	45	50	47	30	49	20	51	23
24	39	15	40	26	41	37	42	49	44	00	45	10	47	01	48	52	50	43	52	34	54	26
25	41	06	42	22	43	38	44	55	46	10	47	28	49	30	51	32	53	35	55	38	57	42
26	42	52	44	13	45	34	46	56	48	18	49	41	51	59	54	18	56	37	58	56	61	15
27	44	57	46	26	47	54	49	23	50	51	52	20	54	55	57	30	60	05	62	40	65	14
28	46	55	48	37	50	07	51	43	53	19	54	56	57	55	60	54	63	54	66	33	69	53
29	48	58	50	42	52	27	54	12	55	57	57	42	61	20	64	53	68	35	72	13	75	51
30	51	04	52	59	54	54	56	49	58	44	60	39										
31	53	15	55	22	57	30	59	38	61	46	63	54										
32	55	33	57	56	60	19	62	43	65	07	67	31										
33	58	00	60	19																		
34	60	27																				

Tables of Difference of Ascension.

Degrees of the Decli-nation.	Elevation of the Pole.																			
	1		2		3		4		5		6		7		8		9		10	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M	D.	M.	D.	M.
1	0	1	0	2	0	3	0	4	0	05	0	06	0	7	0	8	0	9	0	11
2	0	2	0	4	0	6	0	8	0	10	0	13	0	15	0	17	0	19	0	21
3	0	3	0	6	0	9	0	13	0	16	0	19	0	22	0	25	0	29	0	32
4	0	4	0	8	0	13	0	17	0	21	0	25	0	30	0	34	0	38	0	42
5	0	5	0	10	0	16	0	21	0	26	0	32	0	37	0	42	0	48	0	53
6	0	6	0	13	0	19	0	25	0	32	0	38	0	44	0	51	0	57	1	04
7	0	7	0	15	0	22	0	30	0	37	0	44	0	52	0	59	1	07	1	14
8	0	8	0	17	0	25	0	34	0	42	0	51	0	59	1	08	1	16	1	25
9	0	9	0	19	0	29	0	38	0	48	0	57	1	07	1	16	1	26	1	36
10	0	11	0	21	0	32	0	42	0	53	1	04	1	14	1	25	1	36	1	47
11	0	12	0	23	0	35	0	47	0	58	1	10	1	22	1	34	1	46	1	58
12	0	13	0	25	0	38	0	51	1	04	1	17	1	30	1	43	1	56	2	09
13	0	14	0	28	0	42	0	56	1	09	1	23	1	37	1	52	2	06	2	20
14	0	15	0	30	0	45	1	00	1	15	1	30	1	45	2	01	2	16	2	31
15	0	16	0	32	0	48	1	04	1	21	1	37	1	53	2	10	2	26	2	42
16	0	17	0	34	0	52	1	09	1	26	1	44	2	01	2	19	2	36	2	54
17	0	18	0	37	0	55	1	14	1	32	1	50	2	09	2	28	2	47	3	05
18	0	19	0	39	0	59	1	18	1	38	1	57	2	17	2	37	2	57	3	17
19	0	21	0	41	1	02	1	23	1	44	2	04	2	25	2	46	3	08	3	29
20	0	22	0	44	1	06	1	27	1	49	2	12	2	34	2	56	3	18	3	41
21	0	23	0	46	1	09	1	32	1	55	2	19	2	41	3	06	3	29	3	53
22	0	24	0	49	1	13	1	37	2	02	2	26	2	50	3	15	3	40	4	05
23	0	25	0	51	1	17	1	42	2	08	2	33	2	59	3	25	3	51	4	18
24	0	27	0	53	1	20	1	47	2	14	2	31	3	00	3	35	4	03	4	30
25	0	28	0	56	1	24	1	52	2	20	2	49	3	17	3	45	4	14	4	43
26	0	29	0	59	1	28	1	57	2	27	2	56	3	26	3	56	4	26	4	56
27	0	31	1	01	1	32	2	03	2	33	3	04	3	35	4	06	4	38	5	09
28	0	32	1	04	1	36	2	08	2	40	3	12	3	45	4	17	4	50	5	23
29	0	33	1	07	1	40	2	13	2	47	3	20	3	54	4	28	5	02	5	37
30	0	35	1	09	1	44	2	19	2	54	3	29	4	04	4	39	5	15	5	51
31	0	36	1	12	1	48	2	24	3	01	3	37	4	14	4	51	5	28	6	05

Tables of Difference of Ascension.

Degrees of the Decli-nation.	Elevation of the Pole.																			
	1		2		3		4		5		6		7		8		9		10	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M	D.	M.	D.	M.
32	0	37	1	15	1	53	2	30	3	08	3	46	4	24	5	02	5	41	6	20
33	0	39	1	18	1	57	2	36	3	15	3	55	4	34	5	14	5	54	6	35
34	0	40	1	21	2	02	2	42	3	23	4	04	4	45	5	26	6	08	6	50
35	0	42	1	24	2	06	2	48	3	31	4	13	4	56	5	39	6	22	7	06
36	0	44	1	27	2	11	2	55	3	39	4	23	5	07	5	52	6	36	7	22
37	0	45	1	30	2	16	3	02	3	47	4	33	5	11	6	05	6	51	7	38
38	0	47	1	34	2	21	3	08	3	55	4	43	5	30	6	18	7	06	7	55
39	0	49	1	37	2	26	3	15	4	04	4	53	5	42	6	32	7	22	8	13
40	0	50	1	41	2	31	3	22	4	13	5	04	5	55	6	46	7	38	8	31
41	0	52	1	44	2	37	3	29	4	22	5	15	6	08	7	01	7	55	8	49
42	0	54	1	48	2	42	3	37	4	31	5	26	6	21	7	16	8	12	9	08
43	0	56	1	52	2	48	3	44	4	41	5	38	6	34	7	32	8	30	9	28
44	0	58	1	56	2	54	3	52	4	51	5	50	6	49	7	48	8	48	9	48
45	1	00	2	00	3	00	4	01	5	01	6	02	7	03	8	05	9	07	10	09
46	1	02	2	04	3	07	4	09	5	12	6	15	7	18	8	22	9	29	10	31
47	1	04	2	09	3	13	4	18	5	23	6	28	7	34	8	40	9	47	10	54
48	1	07	2	13	3	20	4	27	5	35	6	42	7	50	8	59	10	08	11	18
49	1	09	2	18	3	27	4	37	5	47	6	57	8	07	9	19	10	30	11	42
50	1	12	2	23	3	35	4	47	5	59	7	11	8	23	9	39	10	53	12	08
51	1	14	2	28	3	43	4	57	6	12	7	27	8	43	10	00	11	17	12	35
52	1	17	2	34	3	51	5	08	6	26	7	44	9	03	10	22	11	42	13	03
53	1	20	2	39	3	5[illegible]	5	19	6	40	8	01	9	23	10	45	12	08	13	32
54	1	23	2	45	4	08	5	31	6	55	8	19	9	44	11	09	12	35	14	03
55	1	26	2	52	4	18	5	44	7	11	8	38	10	06	11	35	13	04	4	35
56	1	29	2	58	4	27	5	57	7	27	8	58	10	29	12	02	13	35	15	09
57	1	32	3	05	4	38	6	11	7	44	9	19	10	54	12	30	14	07	15	45
58	1	36	3	12	4	49	6	26	8	02	9	41	11	2[illegible]	13	00	14	41	16	23
59	1	40	3	20	5	00	6	41	8	22	10	04	11	48	13	32	15	17	17	04
60	1	44	3	28	5	12	6	57	8	43	10	2	12	17	14	05	15	55	17	47
61	1	48	3	37	5	25	7	15	9	05	10	56	12	48	14	45	16	36	18	33
62	1	53	3	46	5	39	7	33	9	28	11	24	13	21	15	20	17	20	19	22

Tables of Difference of Ascension.

Degrees of the Declination.	Elevation of the Pole.																			
	1		2		3		4		5		6		7		8		9		10	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
63	1	58	3	56	5	54	7	53	9	53	11	54	13	57	16	01	18	07	20	15
64	2	03	4	06	6	10	8	1[illegible]	10	20	12	27	14	55	16	45	18	57	21	12
65	2	09	4	18	6	27	8	37	10	49	13	02	15	16	17	32	19	51	22	13
66	2	15	4	30	6	46	9	02	11	20	13	39	16	01	18	24	20	50	23	20
67	2	21	4	33	7	06	9	29	11	55	14	20	16	49	19	20	21	55	24	33
68	2	29	4	57	7	27	9	58	12	30	15	05	17	42	20	21	23	05	25	53
69	2	36	5	13	7	51	10	30	13	10	15	53	18	39	21	29	24	23	27	21
70	2	45	5	30	8	17	11	05	13	55	16	47	19	43	22	43	25	48	28	59
71	2	54	5	49	8	45	11	43	14	43	17	46	20	53	24	05	27	13	30	48
72	3	05	6	10	9	17	12	26	15	37	18	52	22	12	25	38	29	10	32	52
73	3	16	6	34	9	52	13	13	16	3[illegible]	20	06	23	41	27	22	31	12	35	13
74	3	29	7	00	10	32	14	07	17	46	26	30	25	21	29	21	33	32	37	56
75	3	44	7	29	11	17	15	08	19	03	23	06	27	10	31	38	36	14	41	09
76	4	01	8	03	12	08	16	17	20	33	24	56	29	38	34	19	39	26	45	01
77	4	20	8	42	13	07	17	38	22	16	27	05	32	08	37	30	43	19	49	48
78	4	43	9	27	14	16	19	12	24	18	29	38	35	17	41	23	48	10	56	03
79	5	09	10	21	15	38	21	04	26	45	32	44	39	10	46	18	54	34	65	07
80	5	41	11	25	17	17	23	22	29	45	36	35	44	08	52	51	63	55	90	00
81	6	19	12	44	19	19	26	12	33	32	41	35	50	50	62	33	90	00		
82	7	08	14	23	21	54	29	50	38	30	48	24	60	33	90	00				
83	8	10	16	31	25	16	34	43	45	27	58	52	90	00						
84	9	34	19	24	29	55	41	42	56	21	90	00								
85	11	31	23	31	36	49	53	00	90	00										
86	14	27	30	58	48	23	90	00												
87	19	27	41	47	90	00														
88	36	51	90	00																
89	00	0[illegible]																		

Tables of Difference of Ascension.

Degrees of the Declination.	Elevation of the Pole.																			
	11		12		13		14		15		16		17		18		19		20	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	0	12	0	13	0	14	0	15	0	16	0	17	0	18	0	19	0	21	0	22
2	0	23	0	25	0	28	0	30	0	32	0	34	0	37	0	39	0	42	0	44
3	0	35	0	38	0	42	0	45	0	48	0	52	0	54	0	59	1	02	1	06
4	0	47	0	51	0	56	1	00	1	04	1	09	1	14	1	18	1	23	1	27
5	0	58	1	04	1	09	1	15	1	21	1	26	1	32	1	38	1	44	1	49
6	1	10	1	17	1	23	1	30	1	37	1	44	1	50	1	57	2	04	2	12
7	1	22	1	30	1	37	1	45	1	53	2	01	2	09	2	17	2	25	2	34
8	1	35	1	43	1	52	2	00	2	09	2	19	2	28	2	37	2	46	2	56
9	1	46	1	56	2	06	2	16	2	26	2	36	2	47	2	57	3	08	3	18
10	1	58	2	09	2	20	2	31	2	42	2	54	3	05	3	17	3	20	3	41
11	2	10	2	22	2	34	2	47	2	59	3	12	3	24	3	37	3	50	4	03
12	2	22	2	35	2	49	3	02	3	16	3	30	3	44	3	58	4	12	4	26
13	2	34	2	49	3	03	3	18	3	33	3	48	4	03	4	18	4	34	4	49
14	2	47	3	02	3	18	3	34	3	50	4	06	4	22	4	39	4	56	5	12
15	2	59	3	16	3	33	3	50	4	07	4	24	4	42	5	00	5	18	5	36
16	3	12	3	30	3	48	4	06	4	24	4	43	5	02	5	21	5	40	5	59
17	3	24	3	44	4	03	4	22	4	42	5	02	5	22	5	42	6	02	6	23
18	3	37	3	58	4	18	4	39	5	00	5	21	5	42	6	04	6	25	6	47
19	3	50	4	12	4	34	4	55	5	18	5	40	6	03	6	26	6	49	7	12
20	4	03	4	26	4	49	5	12	5	36	5	59	6	24	6	48	7	12	7	37
21	4	17	4	41	5	05	5	30	5	54	6	19	6	45	7	10	7	36	8	02
22	4	30	4	56	5	21	5	47	6	13	6	39	7	06	7	33	8	00	8	27
23	4	44	5	11	5	37	6	05	6	32	6	59	7	27	7	56	8	24	8	53
24	4	58	5	26	5	54	6	23	6	51	7	20	7	49	8	19	8	49	9	19
25	5	12	5	41	6	11	6	41	7	11	7	41	8	12	8	43	9	14	9	46
26	5	26	5	57	6	28	6	59	7	31	8	02	8	35	9	07	9	40	10	14
27	5	41	6	13	6	45	7	18	7	51	8	24	8	58	9	32	10	06	10	41
28	5	56	6	29	7	03	7	37	8	11	8	46	9	21	9	57	10	33	11	09
29	6	11	6	46	7	21	7	57	8	32	9	09	9	45	10	23	11	00	11	38
30	6	27	7	03	7	40	8	17	8	54	9	32	10	10	10	49	11	28	12	08
31	6	42	7	20	7	59	8	37	9	16	9	55	10	35	11	16	11	56	12	38

Tables of Difference of Ascension.

Degrees of the Declination.	Elevation of the Pole. 11		12		13		14		15		16		17		18		19		20	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
32	6	59	7	38	8	18	8	58	9	39	10	19	11	01	11	43	12	25	13	09
33	7	15	7	56	8	37	9	19	10	01	10	44	11	27	12	11	12	55	13	40
34	7	32	8	15	8	57	9	41	10	25	11	09	11	54	12	40	13	26	14	13
35	7	49	8	34	9	18	10	03	10	49	11	35	12	22	13	09	13	57	14	46
36	8	07	8	53	9	39	10	26	11	13	12	01	12	50	13	39	14	29	15	20
37	8	25	9	13	10	01	10	50	11	39	12	29	13	10	14	10	15	02	15	55
38	8	44	9	34	10	23	11	14	12	05	12	57	13	49	14	42	15	36	16	31
39	9	03	9	55	10	46	11	39	12	32	13	26	14	20	15	15	16	11	17	08
40	9	23	10	16	11	10	12	05	13	00	13	55	14	51	15	49	16	48	17	47
41	9	44	10	39	11	35	12	31	13	28	14	26	15	25	16	24	17	25	18	27
42	10	05	11	02	12	00	12	58	13	58	14	58	15	59	17	01	18	04	19	08
43	10	27	11	26	12	26	13	27	14	29	15	31	16	34	17	38	18	44	19	50
44	10	49	11	51	12	53	13	56	15	00	16	05	17	10	18	17	19	25	20	35
45	11	13	12	16	13	21	14	28	15	33	16	40	17	48	18	58	20	08	21	21
46	11	37	12	43	13	50	14	58	16	07	17	10	18	27	19	40	20	53	22	09
47	12	02	13	11	14	20	15	30	16	42	17	54	19	08	20	23	21	40	22	58
48	12	28	13	39	14	51	16	05	17	19	18	34	19	51	21	09	22	29	23	51
49	12	55	14	09	15	24	16	40	17	57	19	16	20	36	21	57	23	20	24	45
50	13	24	14	40	15	58	17	17	18	37	19	59	21	22	22	47	24	15	25	42
51	13	53	15	13	16	34	17	56	19	19	20	44	22	11	23	39	25	10	26	43
52	14	24	15	47	17	11	18	37	20	03	21	32	23	02	24	34	26	09	27	46
53	14	57	16	23	17	50	19	19	20	50	22	22	23	56	25	3[illegible]	27	11	28	53
54	15	31	17	11	18	32	20	04	21	3[illegible]	23	15	24	53	26	34	28	17	30	04
55	16	07	17	40	19	13	20	52	22	30	24	10	25	53	27	39	29	27	31	19
56	16	45	18	22	20	01	21	42	23	24	25	09	26	57	28	40	30	42	32	3[illegible]
57	17	25	19	06	20	49	22	35	24	22	26	12	28	05	30	01	32	01	34	05
58	18	07	19	52	21	41	23	3[illegible]	25	23	27	10	29	18	31	20	33	26	35	3[illegible]
59	18	52	20	43	22	36	24	31	26	29	28	30	30	35	32	44	34	58	37	17
60	19	40	21	36	23	34	25	3[illegible]	27	39	29	47	31	58	34	15	36	37	39	05
61	20	32	22	23	24	3[illegible]	26	44	28	54	31	09	33	28	35	53	38	24	41	03
62	21	2[illegible]	23	34	25	44	2[illegible]	58	30	16	32	38	35	06	37	40	40	22	43	12

Tables of Difference of Ascension.

Degrees of the Declination.	Elevation of the Pole. 11		12		13		14		15		16		17		18		19		20	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
63	22	26	24	39	26	57	29	18	31	44	34	15	36	52	39	37	42	34	45	35
64	23	29	25	50	28	15	30	4[illegible]	33	19	36	01	38	49	41	46	44	54	48	16
65	24	38	27	07	29	41	32	10	35	04	37	56	40	58	44	10	47	36	51	19
66	25	53	28	31	31	14	34	03	37	00	40	06	43	22	46	52	50	39	54	50
67	27	15	30	03	32	57	35	58	39	08	42	30	46	04	49	56	54	13	59	02
68	28	45	31	45	34	51	38	06	41	33	45	13	49	10	53	52	58	07	64	16
69	30	25	33	37	36	58	40	30	44	16	48	20	52	48	57	50	63	47	71	28
70	32	13	35	44	39	22	43	14	47	24	51	59	57	08	63	13	71	05	90	00
71	34	22	38	07	42	06	46	23	51	06	56	23	62	37	70	40	90	00		
72	36	45	40	51	45	17	50	07	55	33	61	57	70	12	90	00				
73	39	29	44	03	49	02	54	38	61	13	69	42	90	00						
74	42	41	47	50	53	37	60	17	69	08	90	00								
75	46	30	52	30	59	30	68	31	90	00										
76	51	14	58	29	67	49	90	00												
77	57	21	67	02	90	00														
78	66	08	90	00																
79	90	00																		

Tables of Difference of Ascension.

Elevation of the Pole.

Degrees of the Declination.	21		22		23		24		25		26		27		28		29		30	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	0	23	0	24	0	25	0	27	0	28	0	29	0	31	0	32	0	33	0	35
2	0	46	0	49	0	51	0	53	0	56	0	59	1	01	1	04	1	07	1	09
3	1	09	1	13	1	17	1	20	1	24	1	28	1	32	1	36	1	40	1	44
4	1	32	1	37	1	42	1	47	1	52	1	57	2	03	2	0[illegible]	2	13	2	19
5	1	55	2	02	2	08	2	14	2	2[illegible]	2	27	2	33	2	40	2	47	2	54
6	2	19	2	26	2	33	2	41	2	49	2	56	3	04	3	12	3	20	3	29
7	2	42	2	51	2	59	3	08	3	17	3	26	3	35	3	45	3	54	4	04
8	3	06	3	15	3	25	3	35	3	45	3	56	4	06	4	1[illegible]	4	28	4	39
9	3	29	3	40	3	51	4	03	4	14	4	26	4	38	4	50	5	02	5	15
10	3	53	4	05	4	18	4	30	4	53	4	56	5	0[illegible]	5	23	5	38	5	31
11	4	17	4	30	4	44	4	58	5	12	5	26	5	41	5	56	6	11	6	27
12	4	41	4	56	5	11	5	26	5	41	5	57	6	13	6	29	6	46	7	03
13	5	05	5	21	5	38	5	54	6	11	6	28	6	45	7	03	7	21	7	40
14	5	30	5	47	6	05	6	22	6	41	6	59	7	18	7	37	7	56	8	17
15	5	54	6	13	6	32	6	51	7	11	7	31	7	51	8	11	8	32	8	54
16	6	19	6	3[illegible]	6	59	7	20	7	41	8	03	8	24	8	46	9	08	9	32
17	6	44	7	0[illegible]	7	27	7	49	8	12	8	35	8	58	9	21	9	45	10	10
18	7	10	7	33	7	56	8	19	8	43	9	07	9	32	9	56	10	23	10	49
19	7	36	8	00	8	24	8	49	9	14	9	40	10	06	10	33	11	00	11	28
20	8	02	8	27	8	53	9	19	9	46	10	14	10	41	11	09	11	38	12	08
21	8	28	8	55	9	23	9	50	10	19	10	47	11	17	11	46	12	17	12	48
22	8	55	9	24	9	53	10	22	10	52	11	22	11	53	12	24	12	56	13	29
23	9	22	9	53	10	23	10	54	11	25	11	57	12	29	13	03	13	37	14	11
24	9	59	10	22	10	54	11	26	11	59	12	33	13	07	13	42	14	17	14	54
25	10	19	10	52	11	25	11	59	12	34	13	09	13	45	14	21	14	59	15	37
26	10	47	11	22	11	57	12	33	13	09	13	46	14	24	15	02	15	41	16	21
27	11	17	11	53	12	29	13	07	13	45	14	23	15	03	15	43	16	24	17	06
28	11	47	12	24	13	03	13	42	14	21	15	02	15	43	16	25	17	08	17	53
29	12	17	12	56	13	37	14	18	14	59	15	41	16	24	17	08	17	54	18	40

Tables of Difference of Ascension.

Elevation of the Pole.

Degrees of the Declination.	21		22		23		24		25		26		27		28		29		30	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
30	12	48	13	29	14	11	14	54	15	37	16	21	17	06	17	53	18	40	19	28
31	13	20	14	03	14	47	15	31	16	16	17	02	17	50	18	38	19	27	20	18
32	13	53	14	37	15	23	16	09	16	56	17	45	18	34	19	24	20	16	21	09
33	14	26	15	13	16	00	16	48	17	3[illegible]	18	27	19	20	20	12	21	26	22	01
34	15	00	15	49	16	38	17	29	18	20	19	12	20	06	21	01	21	57	22	55
35	15	36	16	26	17	17	18	10	19	03	19	58	20	54	21	51	22	50	23	51
36	16	12	17	04	17	58	18	53	19	48	20	45	21	44	22	44	23	45	24	48
37	16	49	17	44	18	39	19	36	20	34	21	34	22	25	23	37	24	41	25	47
38	17	27	18	24	19	22	20	21	21	22	22	24	23	28	24	33	25	40	26	49
39	18	06	19	06	20	06	21	08	22	11	23	16	24	22	25	30	26	40	27	52
40	18	47	19	49	20	52	21	56	23	02	24	09	25	19	26	30	27	43	28	59
41	19	30	20	34	21	39	22	46	23	5[illegible]	25	05	26	17	27	32	28	48	30	07
42	20	13	21	20	22	28	23	38	24	50	26	03	27	18	28	36	29	56	31	19
43	20	59	22	08	23	19	24	32	25	46	27	03	28	22	29	43	31	07	32	34
44	21	45	22	58	24	12	25	20	26	4[illegible]	28	06	29	28	30	54	32	22	33	53
45	22	34	23	50	25	07	26	26	27	48	29	11	30	38	32	07	33	40	35	16
46	23	26	24	4[illegible]	26	05	27	27	28	52	30	20	31	51	33	24	35	02	36	44
47	24	18	25	41	27	05	28	31	30	00	31	32	33	07	34	46	36	28	38	15
48	24	14	26	40	28	08	29	38	31	11	32	47	34	28	36	11	38	00	39	53
49	26	12	27	42	29	14	[illegible]0	49	32	26	34	08	35	53	37	53	39	39	41	37
50	27	13	28	47	30	23	32	03	33	46	35	33	37	23	39	19	41	21	43	29
51	28	17	29	56	31	37	33	21	35	0[illegible]	37	02	38	59	41	02	44	11	45	29
52	29	26	31	08	32	54	34	44	36	39	38	3[illegible]	40	42	42	53	45	12	47	59
53	30	37	32	25	34	17	36	13	38	14	40	20	42	33	44	53	47	21	50	01
54	31	54	33	47	35	45	37	48	39	46	42	10	44	32	47	02	49	43	52	37
55	33	14	35	14	37	19	39	29	41	45	44	00	46	41	49	35	52	20	55	33
56	34	41	36	48	38	59	41	18	43	44	46	19	49	04	52	02	55	16	58	52
57	36	14	38	28	40	49	43	17	45	53	48	40	51	41	54	58	58	36	62	45
58	37	54	40	17	42	47	45	27	47	16	51	19	54	37	58	19	62	30	67	31

Tables of Difference of Ascension.

Degrees of the Declination.	Elevation of the Pole. 21		22		23		24		25		26		27		28		29		30	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M	D.	M.	D.	M.
59	39	40	42	16	44	57	47	49	50	54	54	16	58	00	62	14	67	18	73	35
60	41	50	44	25	47	19	50	27	53	52	57	39	61	57	67	24	73	46	90	00
61	43	50	46	48	49	59	53	26	57	36	61	38	66	49	73	35	90	00		
62	46	12	49	27	52	58	56	52	61	17	66	32	73	23	90	00				
63	48	53	52	28	56	25	60	54	66	14	73	11	90	00						
64	51	55	55	55	60	29	65	54	72	57	90	00								
65	55	23	60	03	65	21	72	42	90	00										
66	59	34	65	09	72	26	90	00												
67	64	44	72	08	90	00														
68	71	49	90	00																
69	90	00																		

Tables of Difference of Ascension.

Degrees of the Declination.	Elevation of the Pole. 31		32		33		34		35		36		37		38		39		40	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	0	36	0	37	0	39	0	40	0	42	0	44	0	45	0	47	0	49	0	50
2	1	12	1	15	1	18	1	21	1	24	1	27	1	31	1	34	1	37	1	41
3	1	48	1	53	1	57	2	02	2	06	2	11	2	16	2	21	2	26	2	31
4	2	24	2	30	2	36	2	42	2	48	2	55	3	01	3	08	3	15	3	22
5	3	01	3	08	3	15	3	23	3	31	3	39	3	47	3	55	4	04	4	13
6	3	37	3	46	3	55	4	03	4	13	4	23	4	33	4	43	4	53	5	04
7	4	14	3	24	4	34	4	45	4	56	5	07	5	19	5	30	5	42	5	55
8	4	51	5	02	5	14	5	26	5	37	5	52	6	05	6	18	6	32	6	46
9	5	28	5	41	5	54	6	08	6	22	6	37	6	51	7	06	7	22	7	38
10	6	05	6	20	6	35	6	50	7	09	7	22	7	38	7	55	8	13	8	30
11	6	42	6	59	7	15	7	32	7	49	8	07	8	25	8	44	9	03	9	23
12	7	20	7	38	7	56	8	15	8	34	8	53	9	13	9	34	9	55	10	16
13	7	58	8	18	8	37	8	58	9	18	9	39	10	01	10	24	10	45	11	10
14	8	37	8	58	9	19	9	41	10	03	10	26	10	50	11	14	11	39	12	04
15	9	16	9	38	10	01	10	25	10	49	11	14	11	39	12	05	12	32	13	00
16	9	55	10	19	10	44	11	09	11	35	12	02	12	29	12	5[illegible]	13	26	13	55
17	10	35	11	01	11	27	11	54	12	22	12	50	13	19	13	49	14	20	14	52
18	11	16	11	43	12	11	12	40	13	09	13	3[illegible]	14	10	14	42	15	15	15	49
19	11	56	12	26	12	55	13	26	13	57	14	29	15	02	15	36	16	11	6	48
20	12	38	13	09	13	40	14	13	14	46	15	20	15	55	16	31	17	08	17	47
21	13	20	13	53	14	26	15	00	15	36	16	12	16	49	17	27	18	07	18	47
22	14	03	14	37	15	13	15	49	16	27	17	05	17	44	18	24	19	06	19	49
23	14	47	15	23	16	02	16	38	17	17	17	58	18	39	19	22	20	06	20	52
24	15	31	16	09	16	48	17	29	18	10	18	52	19	36	20	21	21	08	21	56
25	16	16	16	56	17	38	18	20	19	03	19	48	20	34	21	21	22	11	23	01
26	17	02	17	45	18	28	19	12	19	58	20	45	21	34	22	24	23	16	24	10
27	17	50	18	34	19	19	20	06	20	54	21	44	22	35	23	28	24	22	25	1[illegible]
28	18	38	19	24	20	12	21	01	21	51	22	44	23	37	24	33	25	30	26	30
29	19	27	20	16	21	06	21	57	22	50	23	45	24	41	25	40	26	40	27	43
30	20	18	21	09	22	01	22	55	23	51	24	48	25	47	26	4[illegible]	27	52	28	59
31	21	10	22	03	22	58	23	55	24	53	25	53	26	55	28	00	29	07	30	1[illegible]
32	22	03	22	59	23	56	24	56	25	57	27	00	28	05	29	13	30	24	31	37

Tables of Difference of Ascension.

Degrees of the Declination.	Elevation of the Pole.																			
	31		32		33		34		35		36		37		38		39		40	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
33	22	58	23	56	24	57	25	59	27	03	28	09	29	18	30	29	31	44	33	01
34	23	55	24	56	25	59	27	04	28	11	29	21	30	32	31	48	33	06	34	28
35	24	53	25	57	27	03	28	11	29	22	30	35	31	50	33	10	34	33	35	59
36	25	53	27	00	28	09	29	21	30	35	31	52	33	12	34	36	36	02	37	33
37	26	55	28	05	29	18	30	32	31	50	33	12	34	32	36	04	37	36	39	13
38	28	00	29	13	30	29	31	48	33	10	34	36	36	04	37	37	39	15	40	58
39	29	07	30	23	31	44	33	06	34	33	36	02	37	36	39	15	40	59	42	49
40	30	17	31	37	33	01	34	28	35	59	37	33	39	13	40	58	42	49	44	45
41	31	29	32	54	34	22	35	53	37	3[illegible]	39	10	40	55	42	47	44	45	46	50
42	32	45	34	15	35	47	37	23	39	05	40	52	42	44	44	42	46	49	49	04
43	34	05	35	38	37	16	38	59	40	46	42	39	44	39	46	46	49	02	51	29
44	35	28	37	07	38	50	40	39	42	33	44	33	46	42	48	59	51	27	54	08
45	36	56	38	40	40	3[illegible]	42	25	44	20	45	30	48	54	51	22	54	04	57	03
46	38	2[illegible]	40	19	42	16	44	18	45	29	48	4[illegible]	51	1[illegible]	54	00	56	57	60	20
47	40	07	42	04	44	08	46	20	48	40	51	11	53	55	56	48	60	16	64	08
48	41	52	43	57	46	09	48	31	51	03	53	48	56	49	60	11	64	04	68	44
49	43	44	45	57	48	20	50	53	53	40	56	42	60	00	64	00	68	41	74	52
50	45	43	48	0[illegible]	50	43	53	30	56	34	59	59	63	46	68	36	74	49	90	00
51	47	54	50	30	53	19	56	24	59	51	63	48	68	31	74	45	90	00		
52	50	16	53	07	56	13	59	42	63	40	68	25	74	42	90	00				
53	52	53	56	01	59	31	63	31	68	19	74	37	90	00						
54	55	48	59	19	63	21	68	11	74	32	90	00								
55	59	06	63	1[illegible]	68	02	74	26	90	00										
56	62	59	67	53	74	19	90	00												
57	67	42	74	1[illegible]	90	00														
58	74	04	90	00																
59	90	00																		

Tables of Difference of Ascension.

Degrees of the Declination.	Elevation of the Pole.																			
	41		42		43		44		45		46		47		48		49		50	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	0	52	0	54	0	56	0	58	1	0	1	2	1	4	1	07	1	09	1	12
2	1	44	1	48	1	52	1	56	2	0	2	4	2	9	2	13	2	1[illegible]	2	23
3	2	37	2	42	2	48	2	54	3	0	3	7	3	13	3	20	3	27	3	35
4	3	2[illegible]	3	37	3	44	3	52	4	1	4	9	4	18	4	27	4	37	4	47
5	4	22	4	31	4	41	4	51	5	1	5	12	5	23	5	35	5	47	5	59
6	5	15	5	26	5	37	5	5	6	2	6	1[illegible]	6	28	6	42	6	57	7	12
7	6	08	6	21	6	34	6	49	7	5	7	18	7	34	7	50	8	07	8	25
8	7	01	7	16	7	32	7	4[illegible]	8	5	8	22	8	40	8	59	9	18	9	38
9	7	55	8	12	8	3[illegible]	8	48	9	[illegible]	9	26	9	47	10	08	10	30	10	53
10	8	49	9	08	9	28	9	48	10	9	10	31	10	54	11	18	11	42	12	08
11	9	44	10	05	10	27	10	4	11	12	11	5[illegible]	12	01	12	28	12	55	13	24
12	10	39	11	02	11	26	11	51	12	16	12	43	13	11	13	39	14	0[illegible]	14	40
13	11	35	12	00	12	26	12	53	13	21	13	50	14	2[illegible]	14	51	15	24	15	58
14	12	31	12	58	13	27	13	56	14	26	14	58	15	30	16	05	16	40	17	17
15	13	28	13	58	14	28	15	00	15	32	16	07	16	42	17	19	17	57	18	37
16	14	26	14	58	15	31	16	05	16	4[illegible]	17	16	17	54	18	34	19	16	19	59
17	15	25	15	59	16	34	17	1[illegible]	17	48	18	27	19	08	19	51	20	36	21	22
18	16	24	17	01	17	38	18	17	18	59	19	40	20	2[illegible]	21	09	21	57	22	47
19	17	25	18	04	18	41	19	25	20	09	20	53	21	40	22	2[illegible]	23	10	24	14
20	18	27	19	08	19	51	20	35	21	21	22	08	22	5[illegible]	23	51	24	45	25	42
21	19	30	20	13	20	59	21	46	22	34	23	25	24	10	25	14	26	12	27	14
22	20	34	21	20	22	08	22	58	23	50	24	4[illegible]	25	40	26	40	27	42	28	47
23	21	39	22	28	23	19	24	12	25	07	26	0[illegible]	27	05	28	08	29	14	30	23
24	22	46	23	38	24	32	25	28	26	26	27	2[illegible]	28	31	29	3[illegible]	30	48	32	03
25	23	55	24	50	25	47	26	46	27	48	28	52	30	00	31	12	32	26	33	46
26	25	05	26	03	27	03	28	06	29	11	30	20	31	32	32	48	34	08	35	32
27	26	17	27	18	28	22	29	29	30	38	31	51	3[illegible]	07	34	28	35	53	37	2[illegible]
28	27	31	28	36	29	44	30	54	32	07	33	25	34	46	36	12	37	43	39	19
29	28	48	29	56	31	05	32	22	33	40	35	02	36	28	38	00	39	37	41	21
30	30	07	31	09	32	35	33	53	35	16	36	43	38	15	39	53	41	37	43	29
31	31	29	32	45	34	05	35	28	36	56	38	29	40	07	41	52	43	41	45	44

Tables of Difference of Ascension.

Elevation of the Pole.

Degrees of the Declination.	41		42		43		44		45		46		47		48		49		50	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
32	32	54	34	14	35	38	37	07	38	40	40	19	42	04	43	57	45	57	48	08
33	34	22	35	47	37	16	38	50	40	30	42	16	44	08	46	09	48	20	50	43
34	35	53	37	23	38	59	40	39	42	25	44	18	46	20	48	31	50	53	53	40
35	37	39	39	05	40	46	42	33	44	26	46	29	48	40	51	03	53	40	56	34
36	39	10	40	52	42	39	44	33	46	36	48	48	51	11	53	48	56	42	59	59
37	40	55	42	44	44	39	46	42	48	54	51	17	53	55	56	49	60	06	63	46
38	42	47	44	42	46	46	48	59	51	22	54	00	56	48	60	11	64	00	68	36
39	44	45	46	49	49	02	51	27	54	03	56	57	60	16	64	04	68	41	74	49
40	46	50	49	04	51	29	54	08	57	04	60	20	64	08	68	44	74	52	90	00
41	49	05	51	31	54	09	57	05	60	23	64	10	68	47	74	54	90	00		
42	51	3[illegible]	54	10	57	06	60	24	64	13	68	49	74	55	90	00				
43	54	09	57	06	60	24	64	14	68	49	74	56	90	00						
44	57	0[illegible]	60	24	64	14	68	50	74	57	90	00								
45	60	23	64	13	68	49	74	57	90	00										
46	64	10	68	39	74	56	90	00												
47	68	47	74	55	90	00														
48	74	54	90	00																
49	90	00																		

Tables of Difference of Ascension.

Elevation of the Pole.

Degrees of the Declination.	51		52		53		54		55		56		57		58		59		60	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	1	14	1	17	1	20	1	23	1	26	1	29	1	32	1	36	1	40	1	44
2	2	28	2	34	2	39	2	45	2	52	2	58	3	05	3	12	3	20	3	28
3	3	43	3	51	3	59	4	08	4	18	4	27	4	38	4	40	5	00	5	13
4	4	57	5	08	5	19	5	31	5	44	5	57	6	11	6	25	6	41	6	57
5	6	12	6	26	6	40	6	55	7	11	7	27	7	44	8	03	8	22	8	42
6	7	27	7	44	8	01	8	19	8	38	8	58	9	19	9	41	10	04	10	28
7	8	43	9	02	9	23	9	44	10	06	10	29	10	54	11	20	11	47	12	17
8	10	00	10	22	10	45	11	09	11	35	12	01	12	30	13	00	13	31	14	05
9	11	17	11	42	12	08	12	35	13	04	13	35	14	07	14	41	15	17	15	55
10	12	35	13	03	13	32	14	03	14	35	15	09	15	45	16	23	17	04	17	47
11	13	53	14	24	14	57	15	31	16	07	16	45	17	25	18	08	18	53	19	41
12	15	13	15	4[illegible]	16	23	17	00	17	40	18	22	19	06	19	53	20	43	21	36
13	16	34	17	11	17	50	18	32	19	15	20	01	20	56	21	41	22	36	23	34
14	17	56	18	37	19	19	20	04	20	52	21	42	22	35	23	31	24	31	25	35
15	19	19	20	04	20	50	21	38	22	30	23	24	24	22	25	23	26	29	27	39
16	20	44	21	32	22	22	23	15	24	10	25	09	26	12	27	19	29	30	29	47
17	22	11	23	02	23	56	24	53	25	53	26	57	28	05	29	18	30	35	31	59
18	23	39	24	34	25	35	26	34	27	39	28	48	30	01	31	20	32	44	34	19
19	25	1[illegible]	26	09	27	11	28	17	29	27	30	41	32	01	33	26	34	5[illegible]	36	37
20	26	4[illegible]	27	46	28	5[illegible]	30	04	31	19	32	36	34	05	35	37	37	17	39	03
21	28	1[illegible]	29	20	30	37	31	54	33	15	34	41	36	14	37	54	39	42	41	40
22	29	56	31	08	32	25	33	47	35	14	36	48	38	28	40	17	42	15	44	25
23	31	43	32	54	34	17	35	45	37	19	39	[illegible]	40	49	42	47	44	57	47	20
24	33	32	34	44	36	1[illegible]	37	4[illegible]	39	29	41	18	43	17	45	26	47	49	50	27
25	35	21	36	39	38	14	39	59	41	45	43	48	45	54	48	16	50	54	53	52
26	37	10	38	38	40	20	42	10	44	09	46	18	48	41	51	19	54	16	57	39
27	39	0[illegible]	40	42	42	33	44	32	46	41	49	04	51	41	54	38	58	01	61	57
28	41	02	42	53	44	53	47	02	49	24	52	01	54	58	59	19	62	14	67	04
29	43	12	45	12	47	21	49	44	52	20	55	16	58	36	63	31	67	18	73	46

Tables of Difference of Ascension.

Degrees of the Declination.	Elevation of the Pole. 51		52		53		54		55		56		57		58		59		60	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M	D.	M.	D.	M.
30	45	29	47	39	50	01	52	37	55	32	58	52	62	45	67	31	73	55	90	00
31	47	54	50	16	52	53	55	48	59	06	62	58	67	42	74	04	90	00		
32	50	30	53	07	56	01	59	19	63	10	67	53	74	12	90	00				
33	52	19	56	13	59	31	63	21	68	02	74	19	90	00						
34	56	24	59	42	63	31	68	11	74	26	90	00								
35	59	51	63	40	68	19	74	22	90	00										
36	63	48	68	25	74	37	90	00												
37	68	31	70	42	90	00														
38	74	45	90	00																
39	90	00																		

A *Traverse-Table* for every *Point*, *Half-Point*, and *Quarter-Point* of the *Compass*, to the 100 part of a *League* or *Mile*, which gives the *Difference* of *Latitude* and *Departure* from the *Meridian.*

Dist. in Leag. or Miles sail'd	02 deg. 49 min.				05 deg. 37 min.				08 deg. 26 min.				11 deg. 15 min.				Dist. in Leag. or Miles sail'd
	0 Point ¼				00 Point ½				0 Point ¾				1 Point.				
	N	S	E	W	N	S	E	W	N	S	E	W	N	S	E	W	
1	01	00	00	05	01	00	00	10	00	98	00	14	00	98	00	2[illegible]	1
2	02	00	00	10	01	99	00	20	01	97	00	29	01	96	00	39	2
3	03	00	00	15	02	98	00	29	02	96	00	44	02	94	00	58	3
4	04	00	00	2[illegible]	03	98	00	39	03	95	00	58	03	92	00	78	4
5	04	09	00	25	04	97	00	49	04	94	00	73	04	90	00	98	5
6	05	09	00	29	05	97	00	59	05	93	00	88	05	88	01	17	6
7	06	09	00	34	06	97	00	69	06	92	01	02	06	86	01	37	7
8	07	09	00	39	07	96	00	78	07	91	01	17	07	85	01	56	8
9	08	09	00	44	08	96	00	88	08	90	01	32	08	83	01	76	9
10	09	09	00	49	09	95	00	98	09	89	01	46	09	81	01	95	10
11	10	98	00	54	10	95	01	08	10	88	01	61	10	79	02	15	11
12	11	98	00	59	11	94	01	18	11	87	01	76	11	77	02	34	12
13	12	98	00	63	12	94	01	27	12	86	01	91	12	75	02	54	13
14	13	98	00	68	13	93	01	37	13	85	02	05	13	73	02	73	14
15	14	98	00	73	14	93	01	47	14	84	02	2[illegible]	14	71	02	19	15
16	15	98	00	78	15	92	01	57	15	83	02	34	15	69	03	12	16
17	16	98	00	83	16	92	01	67	16	82	02	49	16	67	03	32	17
18	17	97	00	88	17	91	01	76	17	80	02	64	17	65	03	51	18
19	18	97	00	93	18	91	01	86	18	79	02	79	18	64	03	71	19
20	19	97	00	98	19	90	01	96	19	78	02	93	19	62	03	9[illegible]	20
21	20	97	01	03	20	90	02	06	20	77	03	08	20	60	04	10	21
22	21	97	01	08	21	98	02	16	21	76	03	22	21	58	04	29	22
23	22	97	01	13	22	98	02	25	22	75	03	37	22	56	04	49	23
24	23	97	01	17	23	88	02	35	23	74	03	52	23	54	04	68	24
25	24	97	01	22	24	88	02	45	24	73	03	66	24	52	04	88	25
26	25	96	01	27	25	87	02	55	25	71	03	81	25	50	05	07	26
27	26	96	01	32	26	87	02	65	26	70	03	96	26	48	05	27	27
28	27	96	01	32	27	86	02	75	27	69	04	10	27	46	05	46	28
29	28	96	01	42	28	86	02	8[illegible]	28	68	04	25	28	4[illegible]	05	66	29
30	29	96	01	47	29	86	02	94	29	67	04	40	29	42	05	85	30
31	30	90	01	52	30	85	03	04	30	66	04	55	30	40	06	05	31
32	31	06	01	57	31	85	03	14	31	65	04	69	31	38	06	24	32
	E	W	N	S	E	W	N	S	E	W	N	S	E	W	N	S	
	7 Points ¾				7 Points ½				7 Points ¼				7 Points.				
	87 deg. 11 min.				84 deg. 22 min				81 deg. 34 min.				78 deg. 45 min.				

A *Traverse-Table* for every *Point*, *Half-Point*, and *Quarter-Point* of the *Compass*, to the 100 part of a *League* or *Mile*, which gives the *Difference* of *Latitude* and *Departure* from the *Meridian*.

Dist. in Leag. or Miles sail'd	02 deg. 49 min.		05 deg. 37 min.		08 deg. 20 min.		11 deg. 15 min.		Dist. in Leag. or Miles sail'd
	0 Point ¼		00 Point ½		0 Point ¾		1 Point.		
	N S	E W	N S	E W	N S	E W	N S	E W	
33	32 96	01 61	32 84	03 23	32 64	04 84	32 37	06 44	33
34	33 95	01 66	33 84	03 33	33 63	04 98	33 35	06 63	34
35	34 95	01 71	34 83	03 43	34 62	05 13	34 33	06 83	35
36	35 95	01 75	35 83	03 53	35 61	05 28	35 31	07 02	36
37	36 95	01 81	36 82	03 63	36 60	05 42	36 29	07 22	37
38	37 95	01 86	37 82	03 73	37 59	05 57	37 27	07 41	38
39	38 95	01 91	38 81	03 82	38 58	05 72	38 25	07 61	39
40	39 95	01 96	39 81	03 92	39 57	05 87	39 23	07 80	40
41	40 95	02 01	40 80	04 02	40 55	06 02	40 21	08 00	41
42	41 95	02 06	41 80	04 12	41 54	06 16	41 19	08 19	42
43	42 95	02 11	42 79	04 21	42 53	06 31	42 17	08 39	43
44	43 94	02 15	43 79	04 31	43 52	06 45	43 15	08 58	44
45	44 94	02 21	44 78	04 41	44 51	06 60	44 14	08 78	45
46	45 94	02 25	45 78	04 51	45 50	06 75	45 12	08 77	46
47	46 94	02 31	46 77	04 61	46 49	06 89	46 10	09 17	47
48	47 94	02 35	47 77	04 70	47 48	07 04	47 08	09 36	48
49	48 94	02 41	48 76	04 80	48 47	07 19	48 06	09 56	49
50	49 94	02 45	49 76	04 90	49 46	07 33	49 04	09 75	50
51	50 93	02 50	50 75	05 00	50 44	07 48	50 02	09 95	51
52	51 93	02 55	51 75	05 10	51 43	07 63	51 00	10 14	52
53	52 93	02 60	52 74	05 20	52 42	07 77	51 98	10 34	53
54	53 93	02 65	53 74	05 29	53 41	07 92	52 96	10 53	54
55	54 93	02 70	54 73	05 39	54 40	08 07	53 94	10 73	55
56	55 93	02 75	55 73	05 49	55 39	08 21	54 92	10 92	56
57	56 93	02 79	56 72	05 59	56 38	08 36	55 90	11 12	57
58	57 93	02 84	57 72	05 68	57 37	08 51	56 89	11 31	58
59	58 92	02 89	58 71	05 78	58 36	08 65	57 87	11 51	59
60	59 92	02 94	59 71	05 88	59 35	08 80	58 85	11 70	60
70	69 91	03 45	69 66	06 86	69 24	10 27	68 65	13 65	70
80	79 90	03 92	79 61	07 84	79 13	11 73	78 46	15 60	80
90	89 89	04 41	89 56	08 82	89 02	13 20	88 27	17 55	90
100	99 87	04 90	99 51	09 80	98 91	14 67	98 08	19 50	100
200	199 76	09 83	199 02	19 59	197 82	29 34	196 16	39 00	200
	E W	N S	E W	N S	E W	N S	E W	N S	
	7 Points ¾		7 Points ½		7 Points ¼		7 Points.		
	87 deg. 11 min.		84 deg. 22 min.		81 deg. 34 min.		78 deg. 45 min.		

A *Traverse-Table* for every *Point*, *Half-Point*, and *Quarter-Point* of the *Compass*, to the 100 part of a *League* or *Mile*, which gives the *Difference* of *Latitude* and *Departure* from the *Meridian*.

Dist. in Leag. or Miles sail'd	14 deg. 04 min.		16 deg. 52 min.		19 deg. 41 min.		22 deg. 30 min.		Dist. in Leag. or Miles sail'd
	1 Point ¼		1 Point ½		1 Point ¾		2 Points.		
	N S	E W	N S	E W	N S	E W	N S	E W	
1	00 97	00 24	00 96	00 29	00 94	00 34	00 92	00 38	1
2	01 94	00 48	01 91	00 58	01 88	00 67	01 85	00 76	2
3	02 91	00 72	02 87	00 87	02 82	01 01	02 77	01 75	3
4	03 88	00 97	03 83	01 16	03 77	01 34	03 70	01 53	4
5	04 85	01 21	04 78	01 45	04 71	01 68	04 62	01 91	5
6	05 82	01 45	05 74	01 74	05 65	02 02	05 54	02 30	6
7	06 79	01 70	06 70	02 03	06 59	02 35	06 47	02 68	7
8	07 76	01 94	07 66	02 32	07 53	02 70	07 39	03 16	8
9	08 73	02 18	08 61	02 61	08 47	03 03	08 31	03 44	9
10	09 70	02 43	09 57	02 90	09 41	03 37	09 24	03 83	10
11	10 67	02 67	10 53	03 19	10 36	03 71	10 16	04 21	11
12	11 64	02 91	11 48	03 48	11 30	04 04	11 09	04 59	12
13	12 61	03 15	12 44	03 77	12 24	04 38	12 01	04 97	13
14	13 58	03 40	13 40	04 06	13 18	04 72	12 93	05 36	14
15	14 55	03 64	14 35	04 35	14 12	05 05	13 86	05 74	15
16	15 52	03 88	15 31	04 64	15 06	05 39	14 78	06 12	16
17	16 49	04 13	16 27	04 93	16 00	05 73	15 71	06 51	17
18	17 46	04 37	17 22	05 22	16 95	06 06	16 63	06 89	18
19	18 43	04 61	18 18	05 51	17 89	06 40	17 55	07 27	19
20	19 40	04 86	19 14	05 81	18 83	06 74	18 48	07 65	20
21	20 37	05 10	20 10	06 10	19 77	07 08	19 40	08 04	21
22	21 34	05 34	21 05	06 39	20 71	07 41	20 32	08 42	22
23	22 34	05 48	22 01	06 68	21 66	07 75	21 25	08 80	23
24	23 28	05 83	22 97	06 97	22 60	08 08	22 17	09 18	24
25	24 25	06 07	23 92	07 26	23 54	08 42	23 10	09 57	25
26	25 22	06 31	24 88	07 55	24 48	08 76	24 02	09 95	26
27	26 19	06 56	25 84	07 84	25 42	09 10	24 94	10 33	27
28	27 16	06 80	26 79	08 13	26 36	09 43	25 87	10 71	28
29	28 13	07 04	27 75	08 42	27 30	09 77	26 79	11 10	29
30	29 10	07 28	28 71	08 71	28 25	10 11	27 72	11 48	30
31	30 07	07 53	29 66	09 00	29 19	10 44	28 64	11 86	31
32	31 04	07 77	30 62	09 29	30 13	10 78	29 56	12 25	32
	E W	N S	E W	N S	E W	N S	E W	N S	
	6 Points ¾		6 Points ½		6 Points ¼		6 Points.		
	75 deg. 56 min.		73 deg. 07 min.		70 deg. 19 min.		67 deg. 30 min.		

A *Traverse-Table* for every *Point*, *Half-Point*, and *Quarter-Point* of the *Compass*, to the 100 part of a *League* or *Mile*, which gives the *Difference* of *Latitude* and *Departure* from the *Meridian*.

Dist. in Leag. or Miles sail'd	14 deg. 04 min.				16 deg. 52 min				19 deg. 41 min.				22 deg. 30 min.				Dist. in Leag. or Miles sail'd
	1 Point $\frac{1}{4}$				1 Point $\frac{1}{2}$				1 Point $\frac{3}{4}$				2 Points.				
	N	S	E	W	N	S	E	W	N	S	E	W	N	S	E	W	
33	32	01	08	01	31	58	09	58	31	07	11	12	30	49	12	63	33
34	32	98	08	26	32	54	09	87	32	01	11	45	31	44	13	01	34
35	33	95	08	50	33	49	10	16	32	95	11	79	32	34	13	39	35
36	34	92	08	74	34	45	10	45	33	89	12	13	33	26	13	78	36
37	35	89	08	99	35	41	10	74	34	84	12	47	34	18	14	16	37
38	36	26	09	23	36	36	11	03	35	78	12	80	35	11	14	54	38
39	37	83	09	47	37	32	11	32	36	72	13	14	36	03	14	92	39
40	38	80	09	71	38	28	11	61	37	66	13	48	36	90	15	31	40
41	39	77	09	96	39	23	11	90	38	60	13	81	37	88	15	69	41
42	40	74	10	20	40	19	12	19	39	34	14	15	38	80	16	07	42
43	41	71	10	44	41	15	12	48	40	49	14	49	39	73	16	45	43
44	42	68	10	69	42	12	12	77	41	43	14	72	40	65	16	84	44
45	43	65	10	65	43	06	13	06	42	37	15	16	41	57	17	22	45
46	44	62	11	17	44	62	13	35	43	41	15	50	42	50	17	60	46
47	45	59	11	42	44	98	13	64	44	25	15	83	43	42	17	99	47
48	46	56	11	66	45	95	13	93	45	19	16	17	44	35	18	37	48
49	47	33	11	90	46	89	14	22	46	13	16	37	45	27	18	75	49
50	48	50	12	14	47	85	14	51	47	08	16	85	46	19	19	13	50
51	49	47	12	39	48	80	14	80	48	01	17	18	47	12	19	52	51
52	50	44	12	63	49	76	15	09	48	96	17	31	48	04	19	89	52
53	51	41	12	87	50	73	15	38	49	90	17	85	48	97	20	28	53
54	52	38	13	12	51	67	15	67	50	84	18	19	49	89	20	66	54
55	53	35	13	36	52	63	15	96	51	78	18	53	50	81	21	04	55
56	54	32	13	60	53	59	16	26	52	73	18	87	51	73	21	15	56
57	55	29	13	85	54	55	16	55	53	67	19	20	52	66	21	43	57
58	56	26	14	09	55	50	16	84	54	61	19	54	53	58	22	81	58
59	57	23	14	33	56	46	17	25	55	55	19	8	54	21	22	20	59
60	58	20	14	57	57	42	17	42	56	49	20	21	55	43	22	58	60
70	67	90	17	00	66	9	20	3	65	90	23	58	64	67	26	78	70
80	77	60	19	43	76	55	23	21	75	32	26	95	73	91	30	61	80
90	87	30	21	86	86	10	26	12	84	73	30	30	83	14	34	44	90
100	97	00	24	29	95	66	29	02	94	15	33	68	92	38	38	26	100
200	194	00	48	58	191	38	58	04	188	30	67	36	184	76	36	53	200
	E	W	N	S	E	W	N	S	E	W	N	S	E	W	N	S	
	6 Points $\frac{3}{4}$				6 Points $\frac{1}{2}$				6 Points $\frac{1}{4}$				6 Points.				
	75 deg. 56 min.				73 deg. 07 min.				70 deg. 19 min.				67 deg. 30 min.				

A *Traverse-Table* for every *Point*, *Half-Point*, and *Quarter-Point* of the *Compass*, to the 100 part of a *League* or *Mile*, which gives the *Difference* of *Latitude* and *Departure* from the *Meridian*.

Dist. in Leag. or Miles sail'd	25 deg. 19 min.				28 deg. 07 min.				30 deg. 56 min.				33 deg. 45 min.				Dist. in Leag. or Miles sail'd
	2 Points $\frac{1}{4}$				2 Points $\frac{1}{2}$				2 Points $\frac{3}{4}$				3 Points.				
	N	S	E	W	N	S	E	W	N	S	E	W	N	S	E	W	
1	00	90	00	43	00	88	00	47	00	86	00	51	00	83	00	56	1
2	01	81	00	86	01	76	00	94	01	71	01	03	01	66	01	55	2
3	02	71	01	28	02	65	01	41	02	57	01	54	02	49	01	67	3
4	03	61	01	71	03	53	01	89	03	43	02	06	03	32	02	22	4
5	04	52	02	14	04	41	02	36	04	29	02	57	04	16	02	78	5
6	05	42	02	56	05	29	02	83	05	15	03	08	04	99	03	33	6
7	06	33	02	99	06	17	03	30	06	00	03	60	05	82	03	89	7
8	07	23	03	42	07	05	03	77	06	86	04	11	06	65	04	44	8
9	08	14	03	85	07	94	04	24	07	72	04	63	07	48	05	00	9
10	09	04	04	28	08	82	04	71	08	58	05	14	08	31	05	55	10
11	09	94	04	70	09	70	05	18	09	44	05	66	09	15	06	11	11
12	10	85	05	13	10	58	05	66	10	29	06	17	09	98	06	67	12
13	11	75	05	56	11	46	06	13	11	15	06	68	10	81	07	22	13
14	12	66	05	99	12	35	06	60	12	01	07	20	11	64	07	78	14
15	13	56	06	41	13	23	07	07	12	87	07	71	12	47	08	33	15
16	14	46	06	84	14	11	07	54	13	72	08	23	13	30	08	89	16
17	15	37	07	27	14	99	08	01	14	58	08	74	14	13	09	44	17
18	16	27	07	70	15	87	08	48	15	44	09	25	14	97	10	00	18
19	17	18	08	12	16	76	08	96	16	30	09	77	15	80	10	56	19
20	18	08	08	55	17	64	09	43	17	16	10	28	16	63	11	11	20
21	18	98	08	98	18	52	09	90	18	01	10	80	17	46	11	67	21
22	19	89	09	41	19	40	10	37	18	87	11	31	18	29	12	22	22
23	20	79	09	83	20	28	10	84	19	73	11	82	19	12	12	78	23
24	21	60	10	26	21	17	11	31	20	59	12	34	19	95	13	33	24
25	22	60	10	69	22	05	11	78	21	44	12	85	20	79	13	89	25
26	23	50	11	12	22	93	12	25	22	30	13	57	21	62	14	44	26
27	24	41	11	54	23	81	12	73	23	16	13	88	22	45	15	15	27
28	25	31	11	97	24	69	13	20	24	02	14	39	23	28	15	56	28
29	26	22	12	40	25	58	13	67	24	87	14	91	24	11	16	11	29
30	27	12	12	83	26	46	14	14	25	73	15	42	24	94	16	67	30
31	28	02	13	25	27	34	14	61	26	59	15	94	25	78	17	22	31
32	28	93	13	68	28	22	15	08	27	45	16	45	26	61	17	78	32
	E	W	N	S	E	W	N	S	E	W	N	S	E	W	N	S	
	5 Points $\frac{3}{4}$				5 Points $\frac{1}{2}$				5 Points $\frac{1}{4}$				5 Points.				
	64 deg. 42 min.				61 deg. 52 min.				59 deg. 04 min.				56 deg. 15 min.				

A *Traverse-Table* for every *Point*, *Half-Point*, and *Quarter-Point* of the *Compass*, to the 100 part of a *League* or *Mile*, which gives the *Difference* of *Latitude* and *Departure* from the *Meridian*.

Dist. in Leag. or Miles fail'd	25 deg. 19 min.				28 deg. 07 min.				30 deg. 56 min.				33 deg. 45 min.				Dist. in Leag. or Miles fail'd
	2 Points ¼				2 Points ½				2 Points ¾				3 Points.				
	N	S	E	W	N	S	E	W	N	S	E	W	N	S	E	W	
33	29	83	14	11	29	10	15	56	28	31	16	97	27	44	18	33	33
34	30	74	14	54	29	98	16	03	29	16	17	48	28	27	18	89	34
35	31	64	14	96	30	87	16	50	30	02	17	99	29	10	19	44	35
36	32	54	15	39	31	75	16	97	30	88	18	51	29	93	20	00	36
37	33	45	15	82	32	63	17	44	31	74	19	02	30	76	20	56	37
38	34	35	16	25	33	57	17	91	32	59	19	54	31	60	21	11	38
39	35	26	16	68	34	40	18	38	33	45	20	05	32	43	21	67	39
40	36	16	17	11	35	28	18	85	34	31	20	56	33	26	22	22	40
41	37	06	17	53	36	16	19	31	35	17	21	08	34	09	22	78	41
42	37	97	17	96	37	04	19	81	36	02	21	59	34	92	23	33	42
43	38	87	18	38	37	92	20	27	36	88	22	11	35	75	23	89	43
44	39	78	18	81	38	80	20	74	37	74	22	62	36	58	24	44	44
45	40	68	19	24	39	69	21	21	38	60	23	14	37	42	25	00	45
46	41	51	19	67	40	57	21	68	39	46	23	65	38	25	25	56	46
47	42	40	20	09	41	41	22	16	40	31	24	16	39	08	26	11	47
48	43	39	20	52	42	43	22	63	41	17	24	68	39	91	26	67	48
49	44	30	20	95	43	21	23	10	42	03	25	19	40	74	27	22	49
50	45	2[illegible]	21	38	44	10	23	57	42	89	25	71	41	57	27	78	50
51	46	10	21	01	44	98	24	04	43	74	26	22	42	40	28	33	51
52	47	01	22	23	45	86	24	51	44	60	26	73	43	24	28	89	52
53	47	01	22	66	46	74	24	98	45	46	27	25	44	07	29	44	53
54	48	82	23	08	47	62	25	46	46	32	27	76	44	90	30	00	54
55	49	72	23	52	48	51	25	93	47	17	28	28	45	73	30	56	55
56	50	62	23	94	49	39	26	40	48	03	28	79	46	56	31	11	56
57	51	53	24	37	50	27	26	87	48	89	29	30	47	39	31	67	57
58	52	43	24	79	51	15	27	34	49	75	29	82	48	22	32	22	58
59	53	33	25	23	52	03	27	81	50	61	30	33	48	06	32	78	59
60	54	23	25	65	52	91	28	28	51	46	30	84	49	89	33	33	60
70	63	27	29	9[illegible]	61	73	32	99	60	04	35	98	58	22	38	88	70
80	72	31	34	2[illegible]	70	55	37	71	68	61	41	12	66	51	44	44	80
90	81	35	38	47	79	37	42	43	77	19	46	26	74	83	50	00	90
100	[illegible]	3[illegible]	[illegible]	75	88	10	47	13	85	77	51	41	83	14	55	55	100
200	[illegible]	78	85	5[illegible]	176	38	94	26	171	54	102	82	166	28	111	11	200
	E	W	N	S	E	W	N	S	E	W	N	S	E	W	N	S	
	5 Points ¾				5 Points ½				5 Points ¼				5 Points.				
	54 deg. 2[illegible] min.				61 deg. 52 min.				5[illegible] deg. 04 min.				56 deg. 15 min.				

A *Traverse-Table* for every *Point*, *Half-Point*, and *Quarter-Point* of the *Compass*, to the 100 part of a *League* or *Mile*, which gives the *Difference* of *Latitude* and *Departure* from the *Meridian*.

Dist. in Leag. or Miles fail'd	36 deg. 34 min.				39 deg. 22 min.				42 deg. 11 min.				45 deg. 00 min.				Dist. in Leag. or Miles fail'd
	3 Points ¼				3 Points ½				3 Points ¾				4 Points.				
	N	S	E	W	N	S	E	W	N	S	E	W	N	S	E	W	
1	00	80	00	60	00	77	00	63	00	74	00	67	00	71	00	71	1
2	01	61	01	19	01	55	01	27	01	48	01	34	01	41	01	41	2
3	02	41	01	41	02	32	01	90	02	22	02	01	02	12	02	12	3
4	03	21	02	38	03	09	02	54	02	96	02	69	02	83	02	83	4
5	04	02	02	98	03	86	03	17	03	70	03	36	03	54	03	54	5
6	04	82	03	57	04	64	03	81	04	44	04	03	04	24	04	24	6
7	05	62	04	17	05	41	04	44	05	18	04	78	04	95	04	95	7
8	06	43	04	7[illegible]	06	18	05	07	05	93	05	37	05	66	05	66	8
9	07	23	05	36	06	96	05	71	06	67	06	04	06	36	06	36	9
10	08	03	05	96	07	73	06	34	07	41	06	72	07	07	07	07	10
11	08	83	06	55	08	50	06	98	08	15	07	39	07	78	07	78	11
12	09	64	07	15	09	28	07	61	08	89	08	06	08	49	08	49	12
13	10	44	07	74	10	05	08	25	09	63	08	73	09	19	09	19	13
14	11	24	08	34	10	82	08	88	10	37	09	40	09	90	09	90	14
15	12	05	08	94	11	60	09	52	11	11	10	07	10	61	10	61	15
16	12	85	09	53	12	37	10	15	11	85	10	74	11	31	11	31	16
17	13	66	10	13	13	14	10	78	12	70	11	42	12	02	12	02	17
18	14	46	10	72	13	91	11	42	13	34	12	09	12	73	12	73	18
19	15	26	11	32	14	69	12	04	14	08	12	76	13	44	13	44	19
20	16	06	11	91	15	46	12	69	14	82	13	43	14	14	14	14	20
21	16	87	12	51	16	23	13	32	15	56	14	10	14	85	14	85	21
22	17	67	13	11	17	01	13	96	16	30	14	77	15	56	15	56	22
23	18	47	13	70	17	78	14	59	17	04	15	45	16	26	16	26	23
24	19	28	14	30	18	55	15	22	17	78	16	12	16	97	16	97	24
25	20	08	14	89	19	32	15	86	18	52	16	79	17	67	17	68	25
26	20	88	15	49	20	10	16	49	19	26	17	46	18	38	18	38	26
27	21	69	16	08	20	87	17	13	20	00	18	13	19	09	18	09	27
28	22	49	16	68	21	64	17	76	20	75	18	79	19	80	19	80	28
29	23	29	17	27	22	42	18	40	21	49	19	44	20	51	20	51	29
30	24	10	17	87	23	19	19	03	22	23	20	12	21	21	21	21	30
31	24	90	18	47	23	96	19	67	22	97	20	82	21	92	21	92	31
32	25	70	19	06	24	74	20	30	23	71	21	49	22	63	22	63	32
	E	W	N	S	E	W	N	S	E	W	N	S	E	W	N	S	
	4 Points ¾				4 Points ½				4 Points ¼				4 Points.				
	53 deg. 26 min.				50 deg. 3[illegible] min.				47 deg. 49 min.				45 deg. 00 min.				

A *Traverse-Table* for every *Point*, *Half-Point*, and *Quarter-Point* of the *Compass*, to the 100 part of a *League* or *Mile*, which gives the *Difference* of *Latitude* and *Departure* from the *Meridian*.

Dist. in Leag. or Miles sail'd	36 deg. 34 min.		39 deg. 22 min.		42 deg. 11 min.		45 deg. 00 min.		Dist. in Leag. or Miles sail'd
	3 Points ¼		3 Points ½		3 Points ¾		4 Points.		
	N S	E W	N S	E W	N S	E W	N S	E W	
33	26 51	19 66	25 51	20 93	24 45	22 16	23 33	23 33	33
34	27 31	20 25	26 28	21 57	25 19	22 83	24 04	24 04	34
35	28 11	20 85	27 06	22 20	25 93	23 50	24 75	24 75	35
36	28 91	21 46	27 83	22 84	26 67	24 17	25 46	25 46	36
37	29 72	22 04	28 60	23 47	27 41	24 85	26 16	26 16	37
38	30 52	22 64	29 37	24 11	28 16	25 52	26 87	26 87	38
39	31 33	23 23	30 15	24 74	28 90	26 19	27 56	27 56	39
40	32 13	23 83	30 92	25 38	29 64	26 86	28 28	28 28	40
41	32 93	24 42	31 69	26 01	30 38	27 53	28 99	28 99	41
42	33 73	25 02	32 47	26 64	31 12	28 21	29 10	29 10	42
43	34 54	25 61	33 24	27 28	31 86	28 88	30 41	30 41	43
44	35 34	26 21	34 01	27 91	32 60	29 55	31 11	31 11	44
45	36 14	26 81	34 78	28 55	33 34	30 22	31 82	31 82	45
46	36 94	27 40	35 56	29 18	34 08	30 89	32 53	32 53	46
47	37 75	28 00	36 33	29 82	34 82	31 56	33 23	33 23	47
48	38 55	28 59	37 10	30 45	35 57	32 23	33 94	33 94	48
49	39 36	29 19	37 88	31 08	36 31	32 91	34 65	34 65	49
50	40 17	29 78	38 65	31 72	37 05	33 58	35 35	35 35	50
51	40 96	30 38	39 42	32 35	37 79	34 25	36 06	36 06	51
52	41 77	30 98	40 20	32 99	38 53	34 92	36 77	36 77	52
53	42 57	31 57	40 97	33 62	39 27	35 59	37 48	37 48	53
54	43 37	32 17	41 74	34 26	40 01	36 26	38 14	38 14	54
55	44 18	32 76	42 52	34 86	40 75	36 94	38 89	38 89	55
56	44 98	33 36	43 29	35 53	41 49	37 61	39 60	39 60	56
57	45 78	33 96	44 06	36 16	42 23	38 28	40 30	40 30	57
58	46 59	34 55	44 83	36 79	43 07	38 95	41 01	41 01	58
59	47 39	35 15	45 61	37 43	43 72	39 62	41 72	41 72	59
60	48 19	35 74	46 38	38 06	44 45	40 29	42 43	42 43	60
70	56 22	41 69	44 11	44 41	51 85	47 00	49 49	49 49	70
80	64 25	47 65	61 84	50 75	59 26	53 72	56 56	56 56	80
90	72 28	53 61	69 57	57 09	66 67	60 44	63 63	63 63	90
100	80 32	59 56	77 30	63 43	74 08	67 15	70 71	70 71	100
200	160 64	119 12	154 60	126 86	148 16	134 30	141 41	141 41	200
	E W	N S	E W	N S	E W	N S	E W	N S	
	4 Points 2/4		4 Points ½		4 Points ¼		4 Points.		
	53 deg. 26 min.		50 deg. 37 min.		47 deg. 49 min.		45 deg. 00 min.		

A TABLE OF Meridional Parts.

L.	0	1	2	3	4	5	6
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	0	600	1200	1801	2402	3004	3607
1	10	610	1210	1811	2412	3014	3617
2	20	620	1220	1821	2422	3024	3627
3	30	630	1230	1831	2432	3034	3637
4	40	640	1240	1841	2442	3044	3647
5	50	650	1250	1851	2452	3054	3657
6	60	660	1260	1861	2462	3064	3667
7	70	670	1270	1871	2472	3074	3677
8	80	680	1280	1881	2482	3084	3687
9	90	690	1290	1891	2492	3094	3697
10	100	700	1300	1901	2502	3104	3707
11	110	710	1310	1911	2512	3114	3717
12	120	720	1320	1921	2522	3124	3727
13	130	730	1330	1931	2532	3134	3737
14	140	740	1340	1941	2542	3144	3747
15	150	750	1350	1951	2552	3154	3758
16	160	760	1360	1961	2562	3165	3768
17	170	770	1370	1971	2572	3175	3778
18	180	780	1380	1981	2582	3185	3788
19	190	790	1390	1991	2593	3195	3798
20	200	800	1400	2001	2603	3205	3808
21	210	810	1410	2011	2613	3215	3818
22	220	820	1420	2021	2623	3225	3828
23	230	830	1430	2031	2633	3235	3838
24	240	840	1440	2041	2643	3245	3848
25	250	850	1450	2051	2653	3255	3858
26	260	860	1460	2061	2663	3265	3868
27	270	870	1470	2071	2673	3275	3878
28	280	880	1481	2081	2683	3285	3888
29	290	890	1491	2091	2693	3295	3898

L.	0	1	2	3	4	5	6
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	300	900	1501	2101	2702	3305	3908
31	310	910	1511	2111	2713	3315	3919
32	320	920	1521	2121	2723	3325	3929
33	330	930	1531	2131	2733	3335	3939
34	340	940	1541	2141	2743	3345	3949
35	350	950	1551	2151	2753	3355	3959
36	360	960	1561	2161	2763	3365	3969
37	370	970	1571	2171	2773	3375	3979
38	380	980	1581	2182	2783	3386	3989
39	390	990	1591	2192	2793	3396	3999
40	400	1000	1601	2202	2803	3406	4009
41	410	1010	1611	2212	2813	3416	4019
42	420	1020	1621	2222	2823	3426	4029
43	430	1030	1631	2232	2833	3436	4039
44	440	1040	1641	2242	2843	3446	4049
45	450	1050	1651	2252	2853	3456	4059
46	460	1060	1661	2262	2863	3466	4070
47	470	1070	1671	2272	2873	3476	4080
48	480	1080	1681	2282	2883	3486	4090
49	490	1090	1691	2292	2893	3496	4100
50	500	1100	1701	2302	2903	3506	4110
51	510	1110	1711	2312	2914	3516	4120
52	520	1120	1721	2322	2924	3526	4130
53	530	1130	1731	2332	2934	3536	4140
54	540	1140	1741	2342	2944	3546	4150
55	550	1150	1751	2352	2954	3556	4160
56	560	1160	1761	2362	2964	3566	4170
57	570	1170	1771	2372	2974	3576	4180
58	580	1180	1781	2382	2984	3587	4190
59	590	1190	1791	2392	2994	3597	4200

L.	7	8	9	10	11	12	13
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	4211	4816	5422	6031	6641	7253	7868
1	4221	4826	5433	6041	6651	7264	7879
2	4231	4836	5443	6051	6661	7274	7889
3	4241	4846	5453	6061	6671	7284	7899
4	4251	4856	5463	6071	6681	7294	7909
5	4261	4866	5473	6082	6692	7305	7920
6	4271	4876	5483	6092	6702	7315	7930
7	4281	4886	5493	6102	6712	7325	7940
8	4291	4896	5503	6112	6722	7335	7950
9	4301	4907	5514	6122	6732	7346	7961
10	4311	4917	5524	6132	6743	7356	7971
11	4321	4927	5534	6142	6753	7366	7981
12	4331	4937	5544	6153	6763	7376	7991
13	4342	4947	5554	6163	6773	7387	8002
14	4352	4957	5564	6173	6783	7397	8012
15	4362	4967	5574	6183	6794	7407	8022
16	4372	4977	5584	6193	6804	7417	8032
17	4382	4987	5594	6203	6814	7428	8043
18	4392	4998	5605	6213	6824	7438	8053
19	4402	5008	5615	6224	6834	7448	8063
20	4412	5018	5625	6234	6845	7458	8073
21	4422	5028	5635	6244	6855	7469	8084
22	4432	5038	5645	6254	6865	7479	8094
23	4442	5048	5655	6264	6875	7489	8104
24	4452	5058	5666	6274	6885	7499	8114
25	4463	5068	5676	6285	6896	7510	8125
26	4473	5078	5686	6295	6906	7520	8135
27	4483	5089	5696	6305	6916	7530	8145
28	4493	5099	5706	6315	6926	7540	8155
29	4503	5100	5716	6325	6936	7551	8166

L.	7	8	9	10	11	12	13
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	4513	5119	5726	6335	6947	7561	8176
31	4523	5129	5737	6346	6957	7571	8186
32	4533	5139	5747	6356	6967	7581	8196
33	4543	5149	5757	6366	6977	7592	8207
34	4553	5159	5767	6376	6987	7602	8217
35	4563	5169	5777	6386	6998	7612	8227
36	4573	5180	5787	6396	7008	7622	8237
37	4584	5190	5797	6406	7018	7633	8248
38	4594	5200	5808	6417	7028	7643	8258
39	4604	5210	5818	6427	7038	7653	8268
40	4614	5220	5828	6437	7049	7663	8279
41	4624	5230	5838	6447	7059	7674	8289
42	4634	5240	5848	6457	7069	7684	8299
43	4644	5250	5858	6467	7079	7694	8310
44	4654	5260	5868	6477	7089	7704	8320
45	4664	5271	5879	6488	7100	7715	8330
46	4674	5281	5889	6498	7110	7725	8341
47	4684	5291	5899	6508	7120	7735	8351
48	4695	5301	5909	6518	7130	7745	8361
49	4705	5311	5919	6528	7141	7756	8372
50	4715	5321	5929	6539	7151	7766	8382
51	4725	5331	5939	6549	7161	7776	8392
52	4735	5341	5950	6559	7171	7786	8403
53	4745	5351	5960	6569	7182	7797	8413
54	4755	5362	5970	6579	7192	7807	8423
55	4765	5372	5980	6590	7202	7817	8434
56	4775	5382	5990	6600	7212	7827	8444
57	4785	5392	6000	6610	7223	7838	8454
58	4796	5402	6010	6620	7233	7848	8465
59	4806	5412	6021	6630	7243	7858	8475

L.	14	15	16	17	18	19	20
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	8485	9105	9728	10353	10982	11615	12251
1	8495	9115	9738	10363	10993	11625	12262
2	8506	9126	9748	10374	11003	11636	12273
3	8516	9136	9759	10384	11014	11647	12283
4	8526	9146	9769	10395	11024	11657	12294
5	8537	9157	9780	10405	11035	11668	12304
6	8547	9167	9790	10416	11045	11678	12315
7	8557	9177	9800	10426	11056	11689	12326
8	8568	9188	9811	10437	11066	11700	12336
9	8578	9198	9821	10447	11077	11710	12347
10	8589	9208	9832	10458	11087	11721	12358
11	8599	9219	9842	10468	11098	11731	12368
12	8610	9229	9852	10479	11108	11742	12379
13	8620	9239	9863	10489	11119	11752	12390
14	8630	9250	9873	10499	11129	11763	12400
15	8641	9260	9884	10510	11140	11774	12411
16	8651	9270	9894	10520	11150	11784	12422
17	8661	9281	9904	10531	11161	11795	12432
18	8672	9291	9915	10541	11171	11805	12443
19	8682	9301	9925	10552	11182	11816	12454
20	8692	9312	9936	10562	11192	11827	12464
21	8703	9322	9946	10573	11203	11837	12475
22	8713	9332	9956	10583	11213	11848	12486
23	8723	9343	9967	10593	11224	11858	12496
24	8734	9353	9977	10604	11234	11869	12507
25	8744	9363	9988	10614	11245	11880	12518
26	8754	9374	9998	10625	11255	11890	12528
27	8765	9384	10008	10635	11266	11901	12539
28	8775	9394	10019	10646	11276	11911	12550
29	8785	9405	10029	10656	11287	11922	12560

L.	14	15	16	17	18	19	20
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	8796	9415	10040	10667	11297	11932	12571
31	8806	9425	10050	10677	11308	11943	12582
32	8816	9436	10061	10688	11318	11954	12592
33	8827	9446	10071	10698	11329	11964	12603
34	8837	9456	10081	10709	11340	11975	12614
35	8847	9467	10092	10720	11351	11985	12624
36	8858	9477	10102	10730	11361	11996	12635
37	8868	9487	10113	10741	11372	12007	12646
38	8878	9498	10123	10751	11382	12017	12656
39	8889	9508	10134	10762	11393	12028	12667
40	8899	9519	10144	10772	11403	12039	12678
41	8909	9529	10154	10783	11414	12049	12688
42	8920	9539	10165	10793	11424	12060	12699
43	8930	9550	10175	10804	11435	12071	12710
44	8940	9560	10186	10814	11446	12081	12721
45	8951	9571	10196	10825	11456	12092	12731
46	8961	9581	10206	10835	11467	12102	12742
47	8971	9592	10217	10846	11477	12113	12753
48	8982	9602	10227	10856	11488	12124	12763
49	8992	9613	10238	10867	11498	12134	12774
50	9002	9623	10248	10877	11509	12145	12785
51	9012	9634	10259	10888	11520	12155	12795
52	9023	9644	10269	10898	11530	12166	12806
53	9033	9655	10280	10909	11541	12177	12817
54	9043	9665	10290	10919	11551	12187	12827
55	9054	9676	10301	10930	11562	12198	12838
56	9064	9686	10311	10940	11573	12209	12849
57	9074	9696	10322	10951	11583	12219	12860
58	9084	9707	10332	10961	11594	12230	12870
59	9095	9717	10343	10972	11604	12241	12881

L.	21	22	23	24	25	26	27
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	12892	13537	14187	14841	15500	16165	16836
1	12902	13548	14197	14852	15511	16176	16847
2	12913	13558	14208	14863	15522	16187	16858
3	12924	13569	14219	14873	15533	16198	16869
4	12935	13580	14230	14884	15544	16209	16880
5	12945	14590	14241	14895	15555	16220	16891
6	12956	13601	14251	14906	15566	16232	16903
7	12967	13612	14262	14917	15577	16243	16914
8	12978	13623	14273	14928	15588	16254	16925
9	12988	13633	14284	14939	15599	16265	16936
10	12999	13644	14295	14950	15610	16276	16948
11	13010	13655	14306	14961	15621	16287	16959
12	13020	13666	14317	14972	15632	16298	16970
13	13031	13676	14328	14983	15643	16310	16981
14	13042	13687	14339	14994	15654	16320	16993
15	13053	13698	14349	15005	15665	16332	17004
16	13063	13709	14360	15061	15676	16343	17015
17	13074	13720	14371	15027	15687	16354	17026
18	13085	13731	14382	15038	15698	16365	17038
19	13096	13742	14393	15049	15710	16377	17049
20	13106	13753	14404	15060	15721	16388	17060
21	13117	13764	14415	15071	15732	16399	17071
22	13128	13774	14426	15082	15743	16410	17083
23	13138	13785	14437	15093	15754	16421	17094
24	13149	13796	14448	15104	15765	16432	17105
25	13160	13807	14458	15115	15776	16443	17116
26	13171	13818	14469	15126	15787	16455	17128
27	13181	13828	14480	15137	15798	16466	17139
28	13192	13839	14491	15148	15809	16477	17150
29	13203	13850	14502	15159	15820	16488	17161

L.	21	22	23	24	25	26	27
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	13214	13861	14513	15170	15832	16499	17173
31	13224	13872	14524	15181	15843	16510	17184
32	13235	13883	14535	15192	15854	16522	17195
33	13246	13894	14546	15203	15865	16533	17207
34	13257	13904	14557	15214	15876	16544	17218
35	13267	13915	14568	15225	15887	16555	17229
36	13278	13926	14579	15235	15898	16566	17240
37	13289	13937	14589	15247	15909	16578	17252
38	13300	13948	14600	15258	15920	16589	17263
39	13310	13958	14611	15269	15932	16600	17274
40	13321	13969	14622	15280	15943	16611	17286
41	13332	13980	14633	15291	15954	16622	17297
42	13342	13991	14644	15302	15965	16634	17308
43	13353	14002	14655	15313	15976	16645	17319
44	13364	14013	14666	15324	15987	16656	17331
45	13375	14024	14677	15335	15998	16667	17342
46	13386	14034	14688	15346	16009	16678	17353
47	13397	14045	14698	15357	16020	16690	17365
48	13407	14056	14709	15368	16031	16701	17376
49	13418	14067	14720	15379	16043	16712	17387
50	13429	14078	14731	15390	16054	16723	17399
51	13440	14088	14742	15401	16065	16734	17410
52	13450	14099	14753	15412	16076	16746	17421
53	13461	14110	14764	15423	16087	16757	17432
54	13472	14121	14775	15434	16098	16769	17444
55	13483	14132	14786	15445	16109	16780	17455
56	13494	14143	14797	15456	16120	16791	17466
57	13504	14154	14808	15467	16131	16802	17478
58	13515	14165	14819	15478	16143	16813	17489
59	13526	14176	14830	15489	16154	16824	17500

L.	28	29	30	31	32	33	34
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	17512	18195	18884	19581	20284	20996	21715
1	17523	18206	18895	19592	20296	21007	21727
2	17534	18217	18907	19604	20307	21019	21739
3	17546	18229	18919	19615	20319	21031	21751
4	17557	18240	18930	19627	20331	21043	21763
5	17568	18252	18942	19639	20343	21055	21775
6	17580	18263	18953	19650	20355	21067	21787
7	17591	18275	18965	19662	20367	21079	21800
8	17602	18286	18976	19674	20378	21091	21812
9	17614	18297	18988	19685	20390	21103	21824
10	17625	18309	18999	19697	20402	21115	21836
11	17636	18320	19011	19709	20414	21127	21848
12	17648	18332	19023	19720	20426	21139	21860
13	17659	18343	19034	19732	20438	21151	21872
14	17670	18355	19046	19744	20449	21163	21884
15	17682	18366	19057	19756	20461	21175	21896
16	17693	18378	19069	19768	20473	21187	21908
17	17705	18389	19081	19779	20485	21198	21920
18	17716	18401	19092	19791	20497	21210	21933
19	17727	18412	19104	19803	20508	21222	21945
20	17739	18424	19115	19814	20520	21234	21957
21	17750	18435	19127	19826	20532	21246	21969
22	17761	18446	19138	19837	20544	21258	21981
23	17772	18458	19150	19849	20550	21270	21993
24	17784	18469	19162	18861	20568	21282	22005
25	17795	18481	19173	19873	20580	21294	22017
26	17806	18492	19185	19884	20591	21306	22030
27	17818	18504	19196	19896	20603	21318	22042
28	17830	18515	19208	19908	20615	21330	22054
29	17841	18527	19219	19920	20627	21342	22066

L.	28	29	30	31	32	33	34
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	17852	18538	19231	19931	20639	21354	22078
31	17864	18550	19243	19943	20651	21366	22090
32	17875	18561	19254	19955	20662	21378	22102
33	17886	18573	19266	19966	20674	21390	22114
34	17898	18584	19278	19978	20686	21402	22127
35	17909	18596	29289	19990	20698	21414	22139
36	17921	18607	29301	20002	20710	21426	22151
37	17932	18619	29313	20013	20722	21438	22163
38	17943	18630	29324	20025	20734	21450	22175
39	17955	18642	29336	20037	20746	21462	22187
40	17966	18653	19347	20049	20757	21474	22199
41	17978	18665	19359	20060	20769	21486	22212
42	17989	18676	19371	20072	20781	21498	22224
43	18000	18688	19382	20084	20793	21510	22236
44	18012	18699	19394	20096	20805	21522	22248
45	18023	18711	19405	20107	20817	21534	22260
46	18035	18722	19417	20119	20829	21546	22272
47	18046	18734	19429	20131	20841	21558	22285
48	18057	18745	19440	20143	20853	21570	22297
49	18069	18757	19452	20154	20865	21582	22309
50	18080	18768	19464	20166	20877	21594	22321
51	18092	18780	19475	20178	20889	21607	22333
52	18103	18792	19487	20190	20901	21619	22346
53	18114	18703	19499	20202	20913	21631	22358
54	18126	18815	19510	20213	20925	21643	22370
55	18137	18826	19522	20225	20937	21655	22382
56	18149	18838	19534	20237	20949	21667	22394
57	18160	18849	19545	20249	20961	21679	22407
58	18172	18861	19557	20260	20973	21691	22419
59	18183	18872	19569	20272	20985	21703	22431

L.	35	36	37	38	39	40	41
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	22443	23180	23927	24683	25450	26227	27016
1	22455	23193	23939	24696	25462	26240	27029
2	22468	23205	23952	24708	25475	26253	27043
3	22480	23217	23964	24721	25488	26266	27056
4	22492	23230	23977	24734	25501	26279	27069
5	22504	23242	23989	24746	25514	26292	27083
6	22516	23254	24002	24759	25527	26305	27096
7	22529	23267	24014	24771	25540	26319	27109
8	22541	23279	24027	24785	25553	26332	27122
9	22553	23292	24039	24797	25566	26345	27136
10	22565	23304	24052	24810	25578	26358	27149
11	22578	23316	24064	24823	25591	26371	27162
12	22590	23329	24077	24835	25604	26384	27175
13	22602	23341	24090	24848	25617	26397	27189
14	22614	23353	24102	24861	25630	26410	27202
15	22627	23366	24115	24874	25643	26423	27215
16	22639	23378	24127	24886	25656	26436	27229
17	22651	23390	24140	24899	25669	26449	27242
18	22663	23403	24152	24912	25682	26463	27255
19	22676	23415	24165	24925	25695	26476	27269
20	22688	23428	24178	24937	25707	26489	27282
21	22700	23440	24190	24950	25720	26502	27295
22	22712	23453	24203	24963	25733	26515	27308
23	22725	23465	24215	24976	25746	26528	27322
24	22737	23478	24228	24988	25759	26541	27335
25	22749	23490	24240	25001	25772	26554	27348
26	22761	23502	24253	25014	25785	26568	27362
27	22774	23515	24265	25027	25798	26581	27375
28	22786	23527	24278	25034	25811	26594	27388
29	22798	23540	24291	25052	25824	26607	27402

L.	35	36	37	38	39	40	41
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	22810	23552	24303	25065	25837	26620	27415
31	22823	23565	24316	25078	25850	26633	27429
32	22835	23577	24329	25090	25863	26646	27442
33	22847	23589	24341	25103	25876	26660	27455
34	22860	23602	24354	25116	25889	26673	27469
35	22872	23614	24367	25129	25902	26686	27482
36	22884	23627	24379	25142	25915	26699	27495
37	22897	23639	24392	25154	25928	26712	27509
38	22909	23652	24404	25167	25941	26725	27522
39	22921	23664	24417	25180	25954	26739	27535
40	22933	23677	24430	25193	25967	26751	27549
41	22946	23689	24442	25206	25980	26765	27562
42	22958	23702	24455	25218	25993	26778	27576
43	22970	23714	24468	25231	26006	26791	27589
44	22983	23727	24480	25244	26019	26805	27602
45	22995	23739	24493	25257	26032	26818	27615
46	23007	23752	24506	25270	26045	26831	27629
47	23020	23764	24518	25283	26058	26844	27643
48	23032	23777	24531	25295	26071	26857	27656
49	23044	23789	24543	25308	26084	26871	27669
50	23057	23801	24556	25321	26097	26884	27683
51	23069	23813	24569	25334	26110	26898	27696
52	23081	23826	24581	25347	26123	26910	27710
53	23094	23839	24594	25360	26136	26923	27723
54	23106	23851	24607	25372	26149	26937	27737
55	23118	23864	24616	25385	26162	26950	27750
56	23131	23876	24632	25398	26175	26963	27764
57	23143	23889	24645	25411	26188	26976	27777
58	23155	23902	24658	25424	26201	26990	27790
59	23167	23914	24670	25437	26214	27003	27804

L.	42	43	44	45	46	47	48
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	27817	28631	29459	30300	31156	32028	32916
1	27831	28645	29472	30314	31170	32042	32931
2	27844	28658	29486	30328	31185	32057	32946
3	27858	28672	29500	30342	31199	32072	32961
4	27871	28685	29514	30356	31214	32086	32975
5	27885	28700	29528	30370	31228	32101	32990
6	27898	28713	29542	30384	31242	32116	33005
7	27912	28727	29556	30398	31257	32130	33020
8	27925	28741	29570	30413	31271	32145	33035
9	27939	28754	29584	30427	31286	32160	33050
10	27951	28768	29598	30441	31300	32174	33065
11	27966	28782	29611	30455	31315	32189	33080
12	27979	28795	29625	30470	31329	32204	33095
13	27993	28809	29639	30484	31343	32219	33110
14	28006	28823	29653	30498	31358	32233	33125
15	28020	28837	29667	30512	31372	32248	33140
16	28033	28850	29681	30526	31387	32263	33155
17	28047	28864	29695	30541	31401	32277	33170
18	28060	28878	29709	30555	31416	32292	33185
19	28074	28892	29723	30569	31430	32307	33200
20	28087	28905	29737	30583	31445	32322	33215
21	28101	28919	29751	30597	31459	32336	33231
22	28114	28933	29765	30612	31474	32351	33246
23	28128	28947	29779	30626	31488	32366	33261
24	28141	28960	29793	30640	31503	32381	33276
25	28155	28974	29807	30654	31517	32395	33291
26	28168	28988	29821	30669	31532	32410	33306
27	28182	29002	29835	30683	31546	32425	33321
28	28195	29015	29849	30697	31561	32440	33336
29	28209	20029	29863	30711	31575	32455	33351

L.	42	43	44	45	46	47	48
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	28223	29043	29877	30726	31590	32469	33366
31	28236	29057	29891	30740	31604	32484	33381
32	28250	29071	29905	30754	31619	32499	33396
33	28263	29084	29919	30769	31633	32514	33411
34	28277	29097	29933	30783	31648	32529	33427
35	28290	29112	29947	30797	31662	32544	33442
36	28304	29126	29961	30811	31677	32558	33457
37	28318	29140	29975	30826	31691	32573	33472
38	28331	29153	29989	30840	31706	32588	33487
39	28345	29167	30003	30854	31721	32603	33501
40	28358	29181	30018	30869	31735	32618	33517
41	28372	29195	30032	30883	31750	32633	33532
42	28386	29209	30046	30897	31764	32647	33548
43	28399	29223	30060	30912	31779	32662	33563
44	28413	29236	30074	30926	31793	32677	33578
45	28426	29250	30088	30940	31808	32692	33593
46	28440	29264	30102	30955	31823	32707	33608
47	28454	29278	30116	30969	31837	32722	33623
48	28467	29292	30130	30983	31852	32737	33639
49	28481	29306	30144	30998	31866	32752	33654
50	28495	29320	30158	31012	31881	32766	33669
51	28508	29333	30172	31026	31896	32781	33684
52	28522	29347	30187	31041	31910	32796	33699
53	28536	29361	30201	31056	31925	32811	33715
54	28549	29375	30215	31070	31940	32826	33730
55	28563	29389	30229	31084	31954	32841	33745
56	28577	29403	30243	31098	31969	32856	33760
57	28591	29417	30257	31112	31984	32871	33776
58	28605	29431	30271	31127	31998	32886	33791
59	28618	29444	30285	31141	32013	32901	33806

L.	49	50	51	52	53	54	55
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	33821	34745	35688	36652	37638	38647	39680
1	33836	34761	35704	36669	37655	38664	39697
2	33852	34776	35720	36685	37671	38681	39715
3	33867	34792	35736	36701	37688	38698	39732
4	33882	34807	35752	36717	37704	38715	39750
5	38897	34823	35768	36734	37721	38732	39767
6	33913	34839	35784	36750	37738	38749	39785
7	33928	34854	35800	36766	37754	38766	39802
8	33943	34870	35816	36782	37771	38783	39820
9	33959	34885	35832	36799	37788	38800	39837
10	33974	34901	35848	36815	37804	38817	39855
11	33989	34917	35864	36831	37821	38834	39872
12	34004	34932	35880	36848	37838	38851	39890
13	34020	34948	35895	36864	37855	38868	39907
14	34035	34963	35911	36880	37871	38886	39925
15	34050	34979	35927	36897	37888	38903	39942
16	34066	34995	35943	36913	37905	38920	39960
17	34081	35010	35959	36929	37921	38937	39977
18	34196	35026	35975	36946	37938	38954	39995
19	34112	35042	35991	36962	37955	38971	49013
20	34127	35057	36007	36978	37972	38988	40030
21	34142	35073	36023	36995	37988	39005	40048
22	34158	35089	36039	37011	38005	39023	40065
23	34173	35104	36055	37027	38022	39040	40083
24	34188	35120	36071	37044	38039	39057	40100
25	34204	35136	36087	37060	38055	39074	40118
26	34219	35151	36103	37077	38072	39091	40136
27	34235	35167	36119	37093	38089	39109	40153
28	34250	35183	36136	37109	38106	39126	40171
29	34265	35198	36152	37126	38123	39143	40189

L.	49	50	51	52	53	54	55
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	34281	35214	36168	37142	38139	39160	40206
31	34296	35230	36184	37159	38156	39177	40224
32	34312	35246	36200	37175	38173	39195	40242
33	34327	35261	36216	37192	38190	39212	40259
34	34342	35277	36232	37208	38207	39229	40277
35	34358	35293	36248	37224	38223	39246	40295
36	34373	35309	36264	37241	38240	39264	40312
37	34389	35324	36280	37257	38257	39281	40330
38	34404	35340	36296	37274	38274	39298	40348
39	34420	35356	36313	37290	38291	39315	40366
40	34435	35372	36329	37307	38308	39333	40383
41	34450	35388	36345	37323	38325	39350	40401
42	34466	35403	36361	37340	38343	39367	40419
43	34481	35419	36377	37356	38358	39385	40436
44	34497	35425	36393	37373	38375	39402	40454
45	34512	35451	36409	37389	38392	39419	40472
46	34528	35467	36425	37406	38409	39437	40490
47	34543	35482	36442	37422	38426	39454	40508
48	34559	35498	36458	37439	38443	39471	40525
49	34574	35514	36474	37456	38460	39489	40543
50	34590	35530	36490	37472	38477	39506	40561
51	34605	35546	36506	37489	38494	39523	40579
52	34621	35561	36523	37505	38511	39541	40597
53	34636	35577	36539	37522	38528	39558	40614
54	34652	35593	36555	37538	38545	39576	40632
55	34667	35609	36571	37555	38562	39593	40650
56	34683	35625	36587	37572	38579	39610	40668
57	34698	35641	36604	37588	38596	39628	40686
58	34714	35657	36620	37605	38613	39645	40704
59	34730	35673	36636	37621	38630	39663	40722

L.	56	57	58	59	60	61	62
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	40739	41827	42943	44092	45274	46493	47750
1	40757	41845	42962	44111	45294	46513	47771
2	40775	41863	42981	44131	45314	46534	47793
3	40793	41882	43000	44150	45334	46555	47814
4	40811	41900	43019	44170	45354	46575	47835
5	40829	41918	43038	44189	45374	46596	47857
6	40847	41937	43057	44208	45394	46617	47878
7	40865	41955	43076	44228	45414	46637	47900
8	40883	41974	43095	44247	45434	46658	47921
9	40901	41992	43114	44267	45454	46679	47942
10	40919	42011	43132	44286	45475	46699	47964
11	40937	42029	43151	44306	45495	46720	47985
12	40955	42047	43170	44325	45515	46741	48007
13	40973	42066	43189	44345	45535	46762	48028
14	40991	42084	43208	44364	45555	46782	48049
15	41009	42103	43227	44384	45575	46803	48071
16	41027	42121	43246	44404	45595	46824	48092
17	41045	42140	43265	44423	45615	46845	48114
18	41063	42158	43284	44443	45636	46866	48135
19	41081	42177	43303	44462	45656	46886	48157
20	41099	42195	43322	44482	45676	46907	48178
21	41117	42214	43342	44502	45696	46928	48200
22	41135	42232	43361	44521	45716	46949	48222
23	41153	42251	43380	44541	45737	46970	48243
24	41171	42270	43399	44560	45757	46991	48265
25	41189	42288	43418	44580	45777	47012	48286
26	41207	42307	43437	44600	45797	47032	48308
27	41225	42325	43456	44619	45818	47053	48329
28	41243	42344	43475	44639	45838	47074	48351
29	41261	42362	43494	44660	45858	47095	48373

L.	56	57	58	59	60	61	62
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	41279	42381	43513	44678	45878	47116	48394
31	41297	42400	43533	44698	45899	47137	48416
32	41316	42418	43552	44718	45919	47158	48438
33	41334	42437	43571	44738	45939	47179	48459
34	41352	42456	43590	44757	45960	47200	48481
35	41370	42474	43609	44777	45980	47221	48503
36	41388	42493	43628	44797	46001	47242	48525
37	41406	42512	43648	44817	46021	47263	48546
38	41425	42530	43667	44836	46041	47284	48568
39	41443	42549	43686	44856	46062	47305	48590
40	41461	42568	43705	44876	46082	47326	48612
41	41479	42586	43725	44896	46103	47347	48633
42	41497	42605	43744	44916	46123	47369	48655
43	41516	42624	43763	44935	46143	47390	48677
44	41534	42643	43782	44955	46164	47411	48699
45	41552	42661	43802	44975	46184	47432	48721
46	41570	42680	43821	44995	46205	47453	48743
47	41588	42699	43840	45015	46225	47474	48764
48	41607	42718	43859	45035	46246	47495	48786
49	41625	42736	43879	45055	46266	47517	48808
50	41643	42755	43898	45075	46287	47538	488,0
51	41662	42774	43917	45094	46307	47559	48852
52	41680	42793	43937	45114	46328	47580	48874
53	41698	42811	43956	45134	46348	47601	48896
54	41717	42830	43975	45154	46369	47623	48918
55	41735	42849	43995	45174	46390	47644	48940
56	41753	42868	44014	45194	46410	47665	48962
57	41772	42887	44034	45214	46431	47686	48984
58	41790	42906	44053	45234	46451	47708	49006
59	41808	42925	44072	45254	46472	47729	49028

L.	63	64	65	66	67	68	69
M.	*Min.*	*Min.*	*Min.*	*Min.*	*Min*	*Min.*	*Min.*
0	49050	50395	51788	53236	54740	56309	57946
1	49072	50417	51812	53260	54766	56335	57974
2	49094	50440	51836	53285	54792	56362	58002
3	49116	50463	51860	53309	54817	56389	58030
4	49138	50486	51883	53334	54843	56415	58058
5	49160	50509	51907	53359	54869	56442	58086
6	49182	50532	51931	53383	54894	56469	58114
7	49204	50555	51954	53408	54920	56490	58142
8	49226	50577	51978	53433	54946	56523	58170
9	49248	50600	52002	53457	54971	56550	58198
10	49271	50623	52026	53482	54997	56576	58226
11	49293	50646	52050	53507	55023	56603	58254
12	49315	50669	52073	53532	55049	56630	58282
13	49337	50692	52097	53556	55075	56657	58310
14	49359	50715	52121	53581	55100	56684	58339
15	49381	50738	52145	53606	55126	56711	58367
16	49404	50761	52169	53631	55152	56738	58395
17	49426	50784	52193	53656	55178	56765	58423
18	49448	50807	52217	53681	55204	56792	58452
19	49470	50830	52241	53705	55230	56819	58480
20	49493	50853	52265	53730	55256	56846	58508
21	49515	50877	52289	53755	55282	56873	58537
22	49537	50900	52313	53780	55308	56900	58565
23	49560	50923	52337	53805	55334	56928	58593
24	49582	50 46	52361	53830	55360	56955	58622
25	49604	50969	52385	53855	55386	56982	58650
26	49627	50992	52409	53880	55412	57009	58679
27	49649	51015	52433	53905	55438	57036	58707
28	49671	51039	52457	53930	55464	57063	58735
29	49694	51062	52481	53955	55490	57091	58764

L.	63	64	65	66	67	68	69
M.	*Min.*	*Min.*	*Min.*	*Min.*	*Min.*	*Min.*	*Min.*
30	49716	51085	52505	53980	55516	57118	58793
31	49739	51108	52529	54005	55542	57145	58821
32	49761	51131	52553	54030	55568	57173	58850
33	49783	51155	52577	54056	55595	57200	58878
34	49806	51178	52601	54081	55621	57227	58907
35	49828	51201	52626	54106	55647	57255	58936
36	49851	51225	52650	54131	55673	57282	58964
37	49873	51248	52674	54156	55699	57310	58993
38	49896	51271	52698	54181	55726	57337	59022
39	49918	51295	52723	54207	55752	57364	59051
40	49941	51318	52747	54232	55778	57392	59079
41	49963	51341	52771	54257	55805	57419	59108
42	49986	51365	52795	54282	55831	57447	59137
43	50009	51388	52820	54308	55857	57475	59166
44	50031	51412	52844	54333	55884	57502	59195
45	50054	51435	52868	54358	55910	57530	59224
46	50076	51459	52893	54384	55937	57557	59253
47	50099	51482	52917	54409	55963	57585	59281
48	50122	51506	52942	54435	55990	57613	59310
49	50144	51529	52966	54460	56016	57640	59339
50	50167	51553	52990	54485	56043	57668	59368
51	50190	51576	53015	54511	56069	57696	59397
52	50212	51600	53039	54536	56096	57723	59426
53	50235	51623	53064	54562	56122	57751	59455
54	50258	51647	53088	54587	56149	57779	59485
55	50281	51670	53113	54613	56175	57807	59514
56	50303	51694	53137	54638	56202	57835	59543
57	50326	51718	53162	54664	56229	57862	59572
58	50349	51741	53186	54689	56255	57890	59601
59	50372	51765	53211	54715	56282	57918	59630

L.	70	71	72	73	74	75	76
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	59660	61457	63349	65345	67457	69703	72101
1	59689	61488	63381	65379	67494	6 742	72142
2	59718	61519	63414	65413	67530	69781	72183
3	59747	61550	63446	65447	67566	69819	72225
4	59777	61580	63478	65482	67603	69858	72266
5	59806	61611	63511	65516	67639	69897	72308
6	59835	61642	63543	65550	67676	69936	72349
7	59865	61673	63576	65585	67712	69975	72391
8	59894	61704	63609	65619	67749	70014	72433
9	59924	61735	63641	65654	67785	70053	72475
10	59953	61766	63674	65688	67822	70092	72516
11	59983	61797	63706	65723	67858	70131	72558
12	60012	61828	63739	65757	67895	70170	72600
13	60042	61859	63772	65792	67932	70209	72642
14	60071	61890	63805	65826	67969	70248	72684
15	60101	61921	63837	65861	68005	70287	72726
16	60130	61952	63870	65895	68042	70327	72768
17	60160	61983	63903	65930	68079	70366	72810
18	60190	62014	63936	65965	68116	70405	72852
19	60219	62046	63969	66000	68153	70445	72894
20	60249	62077	64002	66034	68190	70484	72937
21	60279	62108	64035	66069	68227	70524	72979
22	60308	62139	64068	66104	68264	70563	73021
23	60338	62171	64101	66139	68301	7060	73064
24	60368	62202	64134	66174	68338	70642	73006
25	60398	62233	64167	66209	68376	70682	73149
26	60427	62265	64200	66244	68413	70722	73191
27	60457	62296	64233	66279	68450	70762	73234
28	60487	62327	64266	66314	68487	70801	73277
29	60517	6235[illegible]	64299	66350	68525	70841	73320

L.	70	71	72	73	74	75	76
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	60547	62390	64332	66385	68562	70881	73362
31	60577	62422	64366	66420	68600	70921	73405
32	60607	62453	64399	66455	68637	70961	73448
33	60637	62485	64432	66491	68675	71001	73491
34	60667	62517	64466	66526	68712	71041	73534
35	60697	62548	64499	66561	68750	71082	73577
36	60727	62580	64533	66597	68787	71122	73620
37	60757	62612	64566	66632	68825	71162	73664
38	60788	62644	64600	66668	68863	71202	73707
39	60818	62675	64633	66703	68901	71243	73750
40	60848	62707	64667	66739	68938	71283	73794
41	60878	62739	64700	66774	68976	71323	73837
42	60908	62771	64734	66810	69014	71364	73880
43	60939	62803	64768	66846	69052	71404	73924
44	60969	62835	64801	66881	69090	71445	73968
45	60999	62866	64835	66917	69128	71486	74011
46	61030	62898	64869	66953	69166	71526	74055
47	61060	62930	64903	66989	69204	71567	74099
48	61091	62962	64936	67024	69242	71608	74142
49	61121	62994	64970	67060	69281	71649	74186
50	61151	63027	65004	67096	69319	71690	74230
51	61182	63059	65038	67132	69357	71730	72274
52	61212	63091	65072	67168	69395	71771	74318
53	61243	63123	65106	67204	69434	71812	74362
54	61274	63155	65140	67240	69472	71853	74406
55	61304	63187	65174	67276	69511	71895	74450
56	61335	63220	65208	67312	69549	71936	74495
57	61365	63252	65242	67349	69588	71977	74539
58	61396	63284	65276	67385	69626	72018	74583
59	61427	63317	65310	67421	69665	72059	74628

L.	77	78	79	80	81	82	83
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
0	74672	77446	80457	83753	87391	91456	96059
1	74717	77494	80510	83810	87455	91527	96141
2	74761	77542	80562	83868	87519	91599	96224
3	74806	77590	80615	83926	87583	91672	96306
4	74850	77639	80668	83983	87648	91744	96389
5	74895	77687	80720	84041	87712	91816	96472
6	74940	77735	80773	84099	87777	91889	96555
7	74985	77784	80826	84158	87841	91962	96638
8	75029	77832	80879	84216	87906	92035	96722
9	75074	77881	80932	84274	87971	92108	96806
10	75119	77930	80985	84333	88036	92181	96890
11	75164	77978	81038	84391	88101	92254	96974
12	75209	78027	81092	84450	88166	92328	97058
13	75254	78076	81145	84509	88232	92402	97142
14	75300	78125	81198	84568	88297	92476	97227
15	75345	78174	81252	84626	88363	92550	97312
16	75390	78223	81306	84686	88428	92624	97397
17	75436	78272	81359	84745	88494	92699	97483
18	75481	78322	81413	84804	88560	92773	97568
19	75527	78371	81467	84863	88626	92848	97654
20	75572	78420	81521	84923	88693	92923	97740
21	75618	78470	81575	84982	88759	92998	97827
22	75663	78519	81629	85042	88826	93073	97913
23	75709	78569	81683	85102	88892	93148	98000
24	75755	78619	81737	85162	88959	93224	98086
25	75801	78668	81792	85222	89026	93300	98173
26	75847	78718	81846	85282	89093	93375	98261
27	75893	78768	81901	85342	89160	93452	98348
28	75939	78818	81955	85402	89227	93528	98436
29	75985	78868	82010	85462	89295	93604	98524

L.	77	78	79	80	81	82	83
M.	Min.	Min.	Min.	Min.	Min.	Min.	Min.
30	76031	78918	82065	85523	89362	93681	98613
31	76077	78968	82120	85584	89430	93758	98701
32	76123	79019	82175	85644	89498	9 835	98790
33	76170	79069	82230	85705	89566	93912	98878
34	76216	79119	82285	85766	89634	93989	98967
35	76263	79170	82341	85827	89702	94066	99057
36	76309	79221	82396	85889	89771	94144	99146
37	76356	79271	82451	85950	89839	94221	99236
38	76402	79322	82507	86011	89908	94299	99327
39	76449	79373	82563	86073	89977	94378	99417
40	76496	79424	82618	86135	90046	94456	99508
41	76543	79475	82674	86196	90115	94534	99598
42	76590	79526	82730	86258	90184	94613	99689
43	76637	79577	82786	86320	90254	94691	99780
44	76684	79628	82842	86382	90323	94770	99872
45	76731	79680	82899	86445	90393	94849	99963
46	76778	79731	82955	86507	90463	94929	100055
47	76826	79782	83011	86569	90533	95008	100148
48	76873	79834	83068	86632	90603	95088	100240
49	76920	79885	83124	86695	90673	95168	100333
50	76968	79937	83181	86757	90744	95248	100426
51	77015	79989	83238	86820	90814	95329	100519
52	77063	80040	83294	86883	90885	95409	100613
53	77110	80092	83351	86946	90956	95489	100706
54	77158	80144	83408	87010	91027	95570	100800
55	77206	80196	83466	87073	91098	95651	100894
56	77254	80248	83523	87136	91169	95732	100989
57	77302	80300	83580	87200	91240	95814	101084
58	77350	80353	83637	87264	91312	95895	101179
59	77398	80405	83695	87327	91384	95977	101274

L.	84	85	86	87	88	89
M.	Min.	Min.	Min.	Min.	Min.	Min.
0	101370	107647	115326	125223	139166	162998
1	101466	107762	115470	125414	139454	163575
2	101562	107877	115614	125607	139744	164163
3	101658	107993	115759	125800	140037	164761
4	101754	108109	115905	125995	140332	165370
5	101851	108225	116050	126191	140630	165949
6	101948	108342	116198	126389	140930	166620
7	102046	108459	116345	126586	141233	167262
8	102144	108577	116493	126786	141539	167917
9	102242	108696	116641	126986	141847	168585
10	102340	108814	116791	127188	142158	169265
11	102438	108933	116940	127391	142472	169906
12	102537	109052	117091	127595	142789	170669
13	102636	109172	117242	127800	143109	171303
14	102735	109291	117394	128007	143432	172132
15	102835	109412	117547	128215	143758	172887
16	102935	109533	117700	128425	144087	173660
17	103035	109655	117854	128635	144419	174450
18	103136	109777	118009	128847	144754	175259
19	103237	109899	118164	129060	145093	176087
20	103338	110022	118320	129274	145435	176936
21	103440	110145	118476	129489	145781	177807
22	103541	110269	118634	129706	146130	178699
23	103643	110393	118792	129925	146483	179616
24	103745	110517	118951	130144	146839	180558
25	103848	110642	119110	130366	147199	181526
26	103951	110768	119271	130588	147563	182523
27	104054	110893	119431	130812	147930	183549
28	104158	111020	119594	131038	148302	184607
29	104262	111146	119756	131265	148678	185698

L.	84	85	86	87	88	89
M.	Min.	Min.	Min.	Min.	Min.	Min.
30	104366	111274	119920	131493	149058	186825
31	104471	111401	120084	131723	149442	187991
32	104575	111529	120249	131955	149830	189197
33	104680	111658	120415	132188	150223	190447
34	104785	111787	120582	132423	150621	191744
35	104891	111917	120749	132659	151023	193092
36	104997	112047	120917	132897	151430	194495
37	105104	112177	121086	133137	151842	195958
38	105211	112309	121256	133378	152258	197486
39	105318	112440	121427	133621	152680	199085
40	105426	112572	121599	133866	153107	200752
41	105533	112705	121771	134112	153540	202525
42	105641	112838	121944	134361	153978	204383
43	105749	112971	122118	134611	154421	206348
44	105858	113106	122293	134863	154870	208431
45	105967	113240	122469	135116	155326	200649
46	106077	113376	122646	135372	155787	213020
47	106187	113511	122824	135630	156255	215566
48	106297	113648	123002	135889	156730	218317
49	106408	113784	123182	136151	157210	221306
50	106519	113922	123363	136414	157698	224580
51	106630	114060	123544	136680	158193	228199
52	106741	114198	123727	136947	158695	232243
53	106853	114337	123910	137217	159204	236829
54	106965	114477	124095	137489	159721	242118
55	107077	114617	124280	137763	160246	248369
56	107191	114758	124467	138039	160779	256008
57	107304	114899	124653	138317	161320	265829
58	107418	115041	124842	138598	161870	279580
59	107533	115183	125031	138881	162429	303643

A TABLE OF THE

MILES *of* East *and* West, *answering to the* Degrees *of* Longitude *in the Fourth* Rumb.

Latitude. D.	Latitude. M.	Miles East & West.	Longitude D.	Longitude M.	Latitude. D.	Latitude. M.	Miles East & West.	Longitude D.	Longitude M.	Latitude. D.	Latitude. M.	Miles East & West.	Longitude D.	Longitude M.
0	0	0	0	0	3	0	180	3	0	6	0	360	6	0
0	10	10	0	10	3	10	190	3	10	6	10	370	6	10
0	20	20	0	20	3	20	200	3	20	6	20	380	6	20
0	30	30	0	30	3	30	210	3	30	6	30	390	6	30
0	40	40	0	40	3	40	220	3	40	6	40	400	6	40
0	50	50	0	50	3	50	230	3	50	6	50	410	6	50
1	0	60	1	0	4	0	240	4	0	7	0	420	7	0
1	10	70	1	10	4	10	250	4	10	7	10	430	7	11
1	20	80	1	20	4	20	260	4	20	7	20	440	7	21
1	30	90	1	30	4	30	270	4	30	7	30	450	7	31
1	40	100	1	40	4	40	280	4	40	7	40	460	7	41
1	50	110	1	50	4	50	290	4	50	7	50	470	7	51
2	0	120	2	0	5	0	300	5	0	8	0	480	8	2
2	10	130	2	10	5	10	310	5	10	8	10	490	8	12
2	20	140	2	20	5	20	320	5	20	8	20	500	8	22
2	30	150	2	30	5	30	330	5	30	8	30	510	8	32
2	40	160	2	40	5	40	340	5	40	8	40	520	8	42
2	50	170	2	50	5	50	350	5	50	8	50	530	8	52

Latitude. D.	Latitude. M.	Miles East & West.	Longitud. D.	Longitud. M	Latitude. D.	Latitude. M.	Miles East & West	Longitud. D.	Longitud. M	Latitude. D.	Latitude. M.	Miles East & West.	Longitude D.	Longitude M.
9	0	540	9	02	15	0	900	15	10	21	0	1260	21	28
9	10	550	9	12	15	10	910	15	21	21	10	1270	21	39
9	20	560	9	22	15	20	920	15	31	21	20	1280	21	50
9	30	570	9	32	15	30	930	15	41	21	30	1290	22	01
9	40	580	9	42	15	40	940	15	51	21	40	1300	22	12
9	50	590	9	52	15	50	950	16	02	21	50	1310	22	22
10	0	600	10	03	16	0	960	16	12	22	0	1320	22	23
10	10	610	10	13	16	10	970	16	23	22	10	1330	22	44
10	20	620	10	23	16	20	980	16	33	22	20	1340	22	55
10	30	630	10	33	16	30	990	16	44	22	30	1350	23	06
10	40	640	10	44	16	40	1000	16	55	22	40	1360	23	17
10	50	650	10	54	16	50	1010	17	05	22	50	1370	23	28
11	0	660	11	04	17	0	1020	17	15	23	0	1380	23	39
11	10	670	11	14	17	10	1030	17	25	23	10	1390	23	49
11	20	680	11	24	17	20	1040	17	36	23	20	1400	23	00
11	30	690	11	34	17	30	1050	17	47	23	30	1410	24	11
11	40	700	11	44	17	40	1060	17	57	23	40	1420	24	22
11	50	710	11	55	17	50	1070	18	08	23	50	1430	24	33
12	0	720	12	05	18	0	1080	18	18	24	0	1440	24	44
12	10	730	12	15	18	10	1090	18	29	24	10	1450	24	55
12	20	740	12	26	18	20	1100	18	39	24	20	1460	25	06
12	30	750	12	36	18	30	1110	18	49	24	30	1470	25	17
12	40	760	12	46	18	40	1120	19	00	24	40	1480	25	28
12	50	770	12	56	18	50	1130	19	10	24	50	1490	25	32
13	0	780	13	07	19	0	1140	19	21	25	0	1500	25	50
13	10	790	13	17	19	10	1150	19	31	25	10	1510	26	01
13	20	800	13	27	19	20	1160	19	42	23	20	1520	26	12
13	30	810	13	38	19	30	1170	19	53	25	30	1530	26	23
13	40	820	13	48	19	40	1180	20	04	25	40	1540	26	34
13	50	830	13	58	19	50	1190	20	14	25	50	1550	26	45
14	0	840	14	08	20	0	120	20	25	26	0	1560	26	56
14	10	850	14	18	20	10	1210	20	35	26	10	1570	27	07
14	20	860	14	29	20	20	1220	20	46	26	20	1580	27	08
14	30	870	14	39	20	30	1230	20	57	26	30	1590	27	29
14	40	880	14	49	20	40	1240	21	07	26	40	1600	27	40
14	50	890	15	00	20	50	1250	21	18	26	50	1610	27	51

Latitude. D.	Latitude. M.	Miles East & West.	Longitude D.	Longitude M.
27	0	1620	28	03
27	10	1630	28	14
27	20	164[illegible]	28	25
27	30	1650	28	37
27	40	166[illegible]	28	4[illegible]
27	50	1670	28	59
28	0	1680	29	11
28	10	1690	29	22
28	20	1700	29	34
28	30	1710	29	46
28	40	1720	29	57
28	50	1730	30	08
29	0	1740	30	19
29	10	1750	30	31
29	20	1760	30	43
29	30	1770	30	54
29	40	1780	31	05
29	50	1790	31	17
30	0	1800	31	28
30	10	1810	31	40
30	20	1820	31	51
30	30	1830	32	03
30	40	1840	32	15
30	50	1850	32	26
31	0	1860	32	38
31	10	1870	32	49
31	20	1880	33	00
31	30	1890	33	12
31	40	1900	33	25
31	50	1910	33	37
32	0	1920	33	48
32	10	1930	34	00
32	20	1940	34	12
32	30	1950	34	24
32	40	1960	34	36
32	50	1970	34	48

Latitude. D.	Latitude. M.	Miles East & West	Longitud. D.	Longitud. M.
33	0	1980	35	00
33	10	1990	35	12
33	20	2000	35	23
33	30	2010	35	35
33	40	2020	35	47
33	50	2030	35	59
34	0	2040	36	11
34	10	2050	36	23
34	20	2060	36	03
34	30	2070	36	47
34	40	2080	36	59
34	50	2090	37	12
35	0	2100	37	24
35	10	2110	37	36
35	20	2120	37	48
35	30	2130	38	00
35	40	2140	38	13
35	50	2150	38	25
36	0	2160	38	38
36	10	2170	38	50
36	20	2180	39	03
36	30	2190	39	15
36	40	2200	39	27
36	50	2210	39	40
37	0	2220	39	53
37	10	2230	40	05
37	20	2240	40	18
37	30	2250	40	31
37	40	2260	40	43
37	50	2270	40	56
38	0	2280	41	08
38	10	2290	41	21
38	20	2300	41	33
38	30	2310	41	46
38	40	2320	42	00
38	50	2330	42	13

Latitude. D.	Latitude. M.	Miles East & West.	Longitude D.	Longitude M.
39	0	2340	42	26
39	10	2350	42	39
39	20	2360	42	52
39	30	2370	43	04
39	40	2380	43	17
39	50	2390	43	30
40	0	2400	43	43
40	10	2410	43	56
40	20	2420	44	09
40	30	2430	44	21
40	40	2440	44	34
40	50	2450	44	48
41	0	2460	45	02
41	10	2470	45	16
41	20	2480	45	29
41	30	2490	45	42
41	40	2500	45	55
41	50	2510	46	08
42	0	2520	46	22
42	10	2530	46	36
42	20	2540	46	49
42	30	2550	47	02
42	40	2560	47	16
42	50	2570	47	30
43	0	2580	47	43
43	10	2590	47	56
43	20	2600	48	10
43	30	2610	48	25
43	40	2620	48	39
43	50	2630	48	53
44	0	2640	49	06
44	10	2650	49	20
44	20	2[illegible]	49	54
44	30	2670	49	48
44	40	2680	50	02
44	50	2690	50	16

Latitude. D.	Latitude. M.	Miles East & West.	Longitude D.	Longitude M.
45	0	2700	50	30
45	10	2710	50	43
45	20	2720	50	57
45	30	2730	51	12
45	40	2740	51	26
45	50	2750	51	40
46	0	2760	51	54
46	10	2770	52	10
46	20	2780	52	25
46	30	2790	52	39
46	40	2800	52	54
46	50	2810	53	08
47	0	2820	53	23
47	10	2830	53	37
47	20	2840	53	52
47	30	2850	54	06
47	40	2860	54	21
47	50	2870	54	36
48	0	2880	54	52
48	10	2890	55	05
48	20	2900	55	22
48	30	2910	55	37
48	40	2920	55	51
48	50	2930	56	07
49	0	2940	56	22
49	10	2950	56	38
49	20	2960	56	52
49	30	2970	57	08
49	40	2980	57	23
49	50	2990	57	39
50	0	3000	57	54
50	10	3010	58	10
50	20	3020	58	26
50	30	3030	58	42
50	40	3140	58	58
50	50	3150	59	14

Latitude. D.	Latitude. M.	Miles East & West	Longitud. D.	Longitud. M.
51	0	3060	59	30
51	10	3070	59	46
51	20	3080	60	01
51	30	3090	60	17
51	40	3100	60	33
51	50	3110	60	49
52	0	3120	61	05
52	10	3130	61	21
52	20	3140	61	37
52	30	3150	61	54
52	40	3160	62	10
52	50	3170	62	26
53	0	3280	62	43
53	10	3290	63	00
53	20	3200	63	17
53	30	3210	63	34
53	40	3220	63	51
53	50	3230	64	08
54	0	3240	64	24
54	10	3250	64	41
54	20	3260	64	58
54	30	3270	65	15
54	40	3280	65	32
54	50	3290	65	50
55	0	3300	66	08
55	10	3310	66	26
55	20	3320	66	42
55	30	3330	67	01
55	40	334	67	19
55	50	3350	67	36
56	0	3360	67	54
56	10	3370	68	11
56	20	3380	68	29
56	30	3390	68	47
56	40	3400	69	05
56	50	3410	69	24

Latitude. D.	Latitude. M.	Miles East & West.	Longitude D.	Longitude M.
57	0	3420	69	42
57	10	3430	70	00
57	20	3440	70	19
57	30	3450	70	38
57	40	3460	70	58
57	50	3470	71	14
58	0	3480	71	34
58	10	3490	71	53
58	20	3500	72	12
58	30	3510	72	31
58	40	3520	72	50
58	50	3530	73	09
59	0	3540	73	28
59	10	3550	73	48
59	20	3560	74	08
59	30	3570	74	26
59	40	3580	74	46
59	50	3590	75	07
60	0	3600	75	26
60	10	3610	75	47
60	20	3620	76	08
60	30	3630	76	28
60	40	3640	76	48
60	50	3650	77	08
61	0	3660	77	29
61	10	3670	77	49
61	20	3680	78	10
61	30	3690	78	31
61	40	3700	78	51
61	50	3710	78	12
62	0	3720	79	34
62	10	3730	79	55
62	20	3740	80	17
62	30	3750	80	38
62	40	3760	81	00
62	50	3770	81	22

Latitude. D.	Latitude. M.	Miles East & West.	Longitude D.	Longitude M.	Latitude. D.	Latitude. M.	Miles East & West.	Longitud. D.	Longitud. M.	Latitude. D.	Latitude. M.	Miles East & West.	Longitude D.	Longitude M.
63	0	3780	81	44	66	0	3960	88	44	69	0	4140	96	33
63	10	3790	82	06	66	10	3970	89	08	69	10	4150	97	02
63	20	3800	82	28	66	20	3980	89	32	69	20	4160	97	30
63	30	3810	82	51	66	30	3990	89	57	69	30	4170	98	00
63	40	3820	83	14	65	40	4000	90	23	69	40	4180	98	29
63	50	3830	83	36	66	50	4010	90	48	69	50	4190	98	58
64	0	3840	83	59	67	0	4020	91	13	70	0	4200	99	26
64	10	3850	84	22	67	10	4030	91	38					
64	20	3860	84	45	67	20	4040	92	04					
64	30	3870	85	09	67	30	4050	92	30					
64	40	3880	85	35	67	40	4060	92	56					
64	50	3890	85	55	67	50	4070	93	23					
65	0	3900	86	19	68	0	4080	93	50					
65	10	3910	86	42	68	10	4090	94	17					
65	20	3920	87	06	68	20	4100	94	44					
65	30	3930	87	29	68	30	4110	95	11					
65	40	3940	87	55	68	40	4120	95	38					
65	50	3950	88	20	68	50	4130	96	05					

A TABLE

A TABLE FOR *Changing the* Degrees *and* Minutes *of* East *and* West *into* MILES.

N 2

Parallel.	1 Minute.		2 Minutes.		3 Minutes.		4 Minutes.		5 Minutes.		6 Minutes.		7 Minutes.		8 Minutes.		9 Minutes.	
	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.
0	1	0	2	0	3	0	4	0	5	0	6	0	7	0	8	0	9	0
1	1	0	2	0	3	0	4	0	5	0	6	0	7	0	8	0	9	0
2	1	0	2	0	3	0	4	0	5	0	6	0	7	0	8	0	9	0
3	1	0	2	0	3	0	4	0	5	0	6	0	7	0	8	0	9	0
4	1	0	2	0	3	0	4	0	5	0	6	0	7	0	8	0	9	0
5	1	0	2	0	3	0	4	0	5	0	6	0	7	0	8	0	9	0
6	1	0	2	0	3	0	4	0	5	0	6	0	7	0	8	0	8	9
7	1	0	2	0	3	0	4	0	5	0	6	0	6	9	7	9	8	9
8	1	0	2	0	3	0	4	0	5	0	5	9	6	9	7	9	8	9
9	1	0	2	0	3	0	4	0	4	9	5	9	6	9	7	9	8	9
10	1	0	2	0	3	0	3	9	4	9	5	9	6	9	7	9	8	9
11	1	0	2	0	2	9	3	9	4	9	5	9	6	9	7	9	8	8
12	1	0	2	0	2	9	3	9	4	9	5	9	6	8	7	8	8	8
13	1	0	1	9	2	9	3	9	4	9	5	8	6	8	7	8	8	8
14	1	0	1	9	2	9	3	9	4	9	5	8	6	8	7	8	8	7
15	1	0	1	9	2	9	3	9	4	8	5	8	6	8	7	7	8	7
16	1	0	1	9	2	9	3	8	4	8	5	8	6	7	7	7	8	7
17	1	0	1	9	2	9	3	8	4	8	5	7	6	7	7	7	8	6
18	1	0	1	9	2	9	3	8	4	8	5	7	6	7	7	6	8	6
19	0	9	1	9	2	8	3	8	4	7	5	7	6	6	7	6	8	5
20	0	9	1	9	2	8	3	8	4	7	5	6	6	6	7	5	8	5
21	0	9	1	9	2	8	3	7	4	7	5	6	6	5	7	5	8	4
22	0	9	1	9	2	8	3	7	4	6	5	6	6	5	7	4	8	3
23	0	9	1	8	2	8	3	7	4	6	5	5	6	4	7	4	8	3
24	0	9	1	8	2	7	3	7	4	6	5	5	6	4	7	3	8	2
25	0	9	1	8	2	7	3	6	4	5	5	4	6	3	7	2	8	2
26	0	9	1	8	2	7	3	6	4	5	5	4	6	3	7	2	8	1
27	0	9	1	8	2	7	3	6	4	5	5	3	6	2	7	1	8	0
28	0	9	1	8	2	6	3	5	4	4	5	3	6	2	7	0	7	9
29	0	9	1	7	2	6	3	5	4	4	5	2	6	1	7	0	7	9
30	0	9	1	7	2	6	3	5	4	3	5	2	6	0	6	9	7	8
31	0	9	1	7	2	6	3	4	4	3	5	1	6	0	6	9	7	7
32	0	8	1	7	2	5	3	4	4	2	5	1	5	9	6	8	7	6
33	0	8	1	7	2	5	3	4	4	2	5	0	5	9	6	7	7	5
34	0	8	1	7	2	5	3	3	4	1	4	9	5	8	6	6	7	5

Parallel.	1 Minute.		2 Minutes.		3 Minutes.		4 Minutes.		5 Minutes.		6 Minutes.		7 Minutes.		8 Minutes.		9 Minutes.	
	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p	M.	c.p.	M.	c.p.
35	0	8	1	6	2	5	3	3	4	1	4	9	5	7	6	5	7	4
36	0	8	1	6	2	4	3	2	4	0	4	9	5	7	6	5	7	3
37	0	8	1	6	2	4	3	2	4	0	4	8	5	6	6	4	7	2
38	0	8	1	6	2	4	3	2	3	9	4	7	5	5	6	3	7	1
39	0	8	1	6	2	3	3	1	3	9	4	7	5	4	6	2	7	0
40	0	8	1	5	2	3	3	1	3	8	4	6	5	4	6	1	6	9
41	0	8	1	5	2	2	3	0	3	8	4	5	5	3	6	0	6	8
42	0	7	1	5	2	2	3	0	3	7	4	5	5	2	5	9	6	7
43	0	7	1	5	2	2	2	9	3	7	4	4	5	1	5	9	6	6
44	0	7	1	4	2	2	2	9	3	6	4	3	5	0	5	8	6	5
45	0	7	1	4	2	1	2	8	3	5	4	2	4	9	5	6	6	4
46	0	7	1	4	2	1	2	8	3	5	4	2	4	9	5	5	6	3
47	0	7	1	4	2	0	2	7	3	4	4	1	4	8	5	5	6	1
48	0	7	1	3	2	0	2	7	3	3	4	0	4	7	5	3	6	0
49	0	7	1	3	2	0	2	6	3	3	3	9	4	6	5	2	5	9
50	0	6	1	3	1	9	2	6	3	2	3	9	4	5	5	1	5	8
51	0	6	1	2	1	9	2	5	3	1	3	8	4	4	5	0	5	7
52	0	6	1	2	1	8	2	4	3	1	3	7	4	3	4	9	5	5
53	0	6	1	2	1	8	2	4	3	0	3	6	4	2	4	8	5	4
54	0	6	1	2	1	8	2	4	2	9	3	5	4	1	4	7	5	2
55	0	6	1	1	1	7	2	3	2	9	3	4	4	0	4	6	5	1
56	0	5	1	1	1	7	2	2	2	8	3	4	3	9	4	5	5	0
57	0	5	1	1	1	6	2	2	2	7	3	3	3	8	4	4	4	9
58	0	5	1	1	1	6	2	1	2	6	3	2	3	7	4	2	4	8
59	0	5	1	0	1	5	2	1	2	6	3	0	3	6	4	1	4	6
60	0	5	1	0	1	5	2	0	2	5	3	0	3	5	4	0	4	5
61	0	5	1	0	1	5	1	9	2	4	2	9	3	4	3	9	4	4
62	0	5	0	9	1	4	1	9	2	3	2	8	3	3	3	8	4	2
63	0	5	0	9	1	4	1	8	2	3	2	7	3	2	3	6	4	1
64	0	4	0	9	1	3	1	8	2	2	2	6	3	1	3	5	3	9
65	0	4	0	8	1	3	1	7	2	1	2	5	3	0	3	4	3	8
66	0	4	0	8	1	2	1	6	2	0	2	4	2	[illegible]	3	2	3	7
67	0	4	0	8	1	2	1	6	2	0	2	3	2	[illegible]	3	1	3	5
68	0	4	0	7	1	1	1	5	1	9	2	2	2	[illegible]	3	0	3	4
69	0	4	0	7	1	1	1	4	1	8	2	1	2	5	2	9	3	[illegible]

Parallel.	10 Minutes M.	c.p.	20 Minutes. M.	c.p.	30 Minutes. M.	c.p.	40 Minutes. M.	c.p.	50 Minutes. M.	c.p.	1 Degree. M.	c.p.	2 Degrees. M.	c.p.	3 Degrees. M.	c.p.	4 Degrees. M.	c.p.
0	10	0	20	0	30	0	40	0	50	0	60	0	120	0	180	0	240	0
1	10	0	20	0	30	0	40	0	50	0	60	0	120	0	180	0	240	0
2	10	0	20	0	30	0	40	0	50	0	60	0	119	9	179	9	239	9
3	10	0	20	0	30	0	39	9	49	9	59	9	119	8	179	8	239	7
4	10	0	20	0	29	9	39	9	49	9	59	9	119	7	179	6	239	4
5	10	0	19	9	29	9	39	8	49	8	59	8	119	5	179	3	239	1
6	9	9	19	9	29	8	39	8	49	7	59	7	119	3	179	0	238	7
7	9	9	19	9	29	8	39	7	49	6	59	6	119	1	178	7	238	2
8	9	9	19	8	29	7	39	6	49	5	59	4	118	8	178	2	237	7
9	9	9	19	8	29	6	39	5	49	4	59	3	118	5	177	8	237	0
10	9	8	19	7	29	5	39	4	49	2	59	0	118	2	177	3	236	4
11	9	8	19	6	29	4	39	3	49	0	58	9	117	8	176	7	235	6
12	9	8	19	6	29	3	39	1	48	9	58	7	117	4	176	0	234	8
13	9	7	19	5	29	2	39	0	48	7	58	5	116	9	175	4	233	8
14	9	7	19	4	29	1	38	8	48	5	58	2	116	4	174	7	232	8
15	9	7	19	3	29	0	38	6	48	3	58	0	115	9	173	9	231	8
16	9	6	19	2	28	8	38	5	48	1	57	7	115	4	173	0	230	7
17	9	6	19	1	28	7	38	2	47	8	57	4	114	8	172	1	229	5
18	9	5	19	0	28	5	38	0	47	6	57	0	114	1	171	1	228	3
19	9	5	18	9	28	4	37	8	47	2	56	7	113	5	170	5	226	9
20	9	4	18	8	28	2	37	6	47	0	56	4	112	8	169	1	225	5
21	9	3	18	7	28	0	37	3	46	7	56	0	112	0	168	0	224	0
22	9	3	18	5	27	8	37	1	46	4	55	6	111	3	166	8	222	5
23	9	2	18	4	27	6	36	8	46	0	55	2	110	5	165	7	220	9
24	9	1	18	3	27	4	36	5	45	7	54	8	109	6	164	4	219	3
25	9	0	18	1	27	1	36	3	45	3	54	4	108	7	163	1	217	5
26	9	0	18	0	27	0	36	0	44	9	53	9	107	9	161	8	215	7
27	8	9	17	8	26	7	35	6	44	6	53	5	106	9	160	4	213	8
28	8	8	17	7	26	5	35	3	44	1	53	0	106	0	158	9	211	9
29	8	7	17	5	26	2	35	0	43	7	52	5	105	0	157	4	209	9
30	8	6	17	3	26	0	34	6	43	3	52	0	103	9	155	9	207	8
31	8	6	17	1	25	7	34	3	42	8	51	4	102	9	154	3	205	7
32	8	5	17	0	25	4	33	9	42	4	50	9	101	8	152	6	203	5
33	8	4	16	8	25	1	33	5	41	9	50	3	100	6	151	0	201	3
34	8	3	16	6	24	9	33	1	41	5	49	7	99	5	149	2	199	0

Parallel.	10 Minutes. M.	c.p.	20 Minutes. M.	c.p.	30 Minutes. M.	c.p.	40 Minutes. M.	c.p.	50 Minutes. M.	c.p.	1 Degree. M.	c.p.	2 Degrees. M.	c.p	3 Degrees. M.	c.p	4 Degrees. M.	c.p.
35	8	2	16	4	24	5	32	8	41	0	49	1	98	2	147	4	196	6
36	8	1	16	2	24	3	32	4	40	5	48	5	97	0	145	6	194	2
37	8	0	16	0	24	0	31	9	39	9	47	9	95	8	143	8	191	7
38	7	9	15	8	23	6	31	5	39	4	47	2	94	5	141	8	189	1
39	7	8	15	5	23	3	31	1	38	9	46	6	93	2	139	9	186	5
40	7	7	15	3	23	0	30	6	38	3	46	0	91	9	137	9	183	8
41	7	5	15	1	22	6	30	1	37	7	45	3	90	6	135	8	181	1
42	7	4	14	9	22	3	29	7	37	2	44	6	89	2	133	8	178	4
43	7	3	14	6	21	9	29	2	36	6	43	9	87	7	131	6	175	5
44	7	2	14	4	21	6	28	8	36	0	43	2	86	3	129	5	172	6
45	7	1	14	1	21	2	28	3	35	4	42	4	84	8	127	2	169	7
46	6	9	13	9	20	8	27	8	34	7	41	6	83	4	125	0	166	7
47	6	8	13	6	20	4	27	2	34	1	40	9	81	8	122	8	163	7
48	6	7	13	3	20	0	26	6	33	3	40	0	79	9	119	9	159	9
49	6	6	13	1	19	7	26	3	32	8	39	4	78	7	118	1	157	5
50	6	4	12	6	19	3	25	7	32	1	38	6	77	1	115	7	154	3
51	6	3	12	9	18	9	25	2	31	5	37	8	75	5	113	3	151	0
52	6	2	12	3	18	5	24	6	30	8	36	9	73	9	110	8	147	8
53	6	0	12	0	18	1	24	1	30	1	36	1	72	2	108	3	144	4
54	5	9	11	8	17	6	23	5	29	4	35	3	70	5	105	8	141	1
55	5	7	11	5	17	2	22	9	28	7	34	4	68	8	103	2	137	6
56	5	6	11	2	16	8	22	4	28	0	33	6	67	1	100	7	134	2
57	5	4	11	9	16	3	21	8	27	2	32	7	65	5	98	3	131	0
58	5	3	10	6	15	9	21	2	26	5	31	8	63	6	95	4	127	2
59	5	2	10	3	15	5	20	6	25	8	30	9	61	8	92	7	123	6
60	5	0	10	0	15	0	20	0	25	0	30	0	60	0	90	0	120	0
61	4	8	9	7	14	5	19	4	24	2	29	1	58	2	87	3	116	4
62	4	7	9	4	14	1	18	8	23	4	28	2	56	3	84	5	112	7
63	4	[illegible]	9	1	13	6	18	2	22	7	27	2	54	5	81	7	109	0
64	4	[illegible]	8	8	13	2	17	5	22	9	26	3	52	6	78	9	105	2
65	4	2	8	5	12	7	16	9	21	1	25	4	50	7	76	1	101	4
66	4	1	8	1	12	2	16	3	20	3	24	4	48	8	73	2	97	6
67	3	9	7	8	11	7	15	6	19	5	23	4	46	9	70	3	93	8
68	3	7	7	5	11	2	15	0	18	7	22	5	45	0	67	4	89	9
69	3	6	7	2	10	8	14	3	17	9	21	5	43	1	64	6	86	1
70	3	3	6	7	10	0	13	4	16	7	20	0	40	1	60	1	80	1

Parallel.	5 Degrees.		6 Degrees.		7 Degrees.		8 Degrees.		9 Degrees.		10 Degrees.		20 Degrees.	
	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.
0	300	0	360	0	420	0	480	0	540	0	600	0	1200	0
1	300	0	359	9	419	9	479	9	539	9	599	9	1199	8
2	299	8	359	8	419	7	479	7	539	7	599	6	1199	3
3	299	6	359	5	419	4	479	3	539	3	599	2	1198	4
4	299	3	359	1	419	0	478	8	538	7	598	5	1197	0
5	298	9	358	6	418	4	478	2	537	9	597	7	1195	4
6	298	4	358	0	417	7	477	4	537	0	596	7	1193	4
7	297	8	357	3	416	9	476	4	536	0	595	5	1191	0
8	297	0	356	5	415	9	475	3	534	7	594	2	1188	3
9	296	3	355	6	414	8	474	1	533	4	592	6	1185	2
10	295	4	354	5	413	6	472	7	531	8	590	9	1181	8
11	294	5	353	4	412	3	471	2	529	0	588	9	1177	9
12	293	4	352	1	410	8	469	5	528	2	586	9	1173	8
13	292	3	350	7	409	2	467	7	526	2	584	6	1169	2
14	291	1	349	3	407	5	465	7	524	0	582	2	1164	4
15	289	8	347	7	405	7	463	6	521	6	579	6	1159	1
16	288	4	346	1	403	7	461	4	519	0	576	7	1153	5
17	286	9	344	3	401	6	459	0	516	4	573	8	1147	6
18	285	7	342	4	399	4	456	5	513	6	570	6	1141	3
19	283	6	340	4	397	1	453	8	510	6	567	3	1134	6
20	281	9	338	3	394	7	451	1	507	4	563	8	1127	6
21	280	1	336	1	392	1	448	1	504	1	560	1	1120	3
22	278	2	333	8	389	4	445	0	500	7	556	3	1112	6
23	276	1	331	4	386	6	441	8	497	1	552	3	1104	6
24	274	1	328	9	384	0	438	5	493	3	548	1	1096	2
25	272	0	326	3	380	6	435	0	489	4	543	8	1087	6
26	269	6	323	6	377	6	431	5	485	3	539	3	1078	5
27	267	3	320	7	374	2	427	7	481	1	534	6	1069	2
28	264	9	317	9	370	8	423	8	476	8	529	8	1059	6
29	262	3	314	9	367	3	419	8	472	3	524	8	1049	6
30	259	8	311	7	363	7	415	7	467	7	519	6	1039	2
31	257	1	308	6	360	0	411	4	462	9	514	3	1028	6
32	254	4	305	3	356	1	407	1	457	9	508	8	1017	6
33	251	6	301	9	352	2	402	6	452	9	503	2	1006	4
34	248	7	[illegible]	5	348	1	397	9	447	7	497	4	994	8

Parallel.	5 Degrees.		6 Degrees.		7 Degrees.		8 Degrees.		9 Degrees.		10 Degrees.		20 Degrees.	
	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.	M.	c.p.
35	245	7	294	8	344	0	393	2	442	3	491	5	983	0
36	242	7	291	2	339	8	388	3	436	9	485	4	970	3
37	239	6	281	5	335	4	383	3	431	2	479	1	958	2
38	236	4	283	7	331	0	378	4	425	5	472	8	945	6
39	233	1	279	8	326	4	373	0	419	7	466	3	932	6
40	229	8	275	8	321	7	367	7	413	6	459	6	919	2
41	226	4	271	7	317	0	362	5	407	5	452	8	905	6
42	222	9	267	5	312	1	356	7	401	3	445	9	891	7
43	219	4	263	3	307	2	351	0	394	9	438	8	877	6
44	215	8	259	0	302	1	345	2	388	4	431	6	863	2
45	212	1	254	5	296	9	339	4	381	8	424	2	848	4
46	208	4	250	0	291	7	333	4	375	1	416	8	833	6
47	204	6	245	5	286	4	327	3	368	2	409	2	818	4
48	199	8	239	8	279	8	319	7	359	7	399	8	799	3
49	196	7	236	2	275	5	314	9	354	2	393	3	787	2
50	192	8	231	4	270	0	308	5	347	1	385	7	771	4
51	188	8	226	6	264	3	302	1	349	8	377	6	755	2
52	184	7	221	6	258	6	295	5	332	5	369	4	738	8
53	180	5	216	6	252	8	288	9	325	0	361	0	722	2
54	176	3	211	6	246	9	282	1	317	4	352	7	705	4
55	172	1	206	5	240	9	275	3	309	7	344	1	688	2
56	167	8	201	3	234	9	268	4	302	0	335	5	671	0
57	163	8	196	9	229	4	262	2	295	0	326	8	653	6
58	159	0	190	8	222	6	254	4	286	2	318	0	636	0
59	154	5	185	4	216	3	247	2	278	1	309	0	618	0
60	150	0	180	0	210	0	240	0	270	0	300	0	600	2
61	145	4	174	5	203	9	232	7	261	8	290	9	581	8
62	140	8	169	0	197	2	225	3	253	5	281	7	563	4
63	136	2	163	4	190	6	217	9	245	2	272	4	544	8
64	131	5	157	8	184	1	210	4	236	7	263	0	526	1
65	126	8	152	1	177	5	202	8	228	2	253	6	507	2
66	122	0	146	4	170	8	195	2	219	6	244	0	488	0
67	117	2	140	7	164	1	187	5	211	0	234	4	468	8
68	112	4	134	8	157	3	179	2	202	3	224	8	449	6
69	107	6	129	1	150	6	172	1	193	6	215	0	430	0
70	100	1	120	2	140	2	160	2	180	2	200	3	400	6

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A TABLE

FOR

Reducing MILES *of* East *and* West *into* Degrees *of* Longitude.

Parallel.	1 Mile.			2 Miles.			3 Miles.			4 Miles.			5 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
0	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0
1	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0
2	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0
3	0	1	0	0	2	0	0	3	0	0	4	0	0	5	0
4	0	1	0	0	2	0	0	3	0	0	4	1	0	5	1
5	0	1	0	0	2	0	0	3	1	0	4	1	0	5	1
6	0	1	0	0	2	1	0	3	1	0	4	1	0	5	2
7	0	1	0	0	2	1	0	3	1	0	4	2	0	5	2
8	0	1	1	0	2	1	0	3	2	0	4	2	0	5	3
9	0	1	1	0	2	1	0	3	2	0	4	3	0	5	5
10	0	1	1	0	2	2	0	3	3	0	4	4	0	5	5
11	0	1	1	0	2	2	0	3	3	0	4	4	0	5	6
12	0	1	2	0	2	3	0	3	4	0	4	5	0	5	7
13	0	1	2	0	2	3	0	3	5	0	4	6	0	5	8
14	0	1	2	0	2	4	0	3	5	0	4	7	0	5	9
15	0	1	2	0	2	4	0	3	6	0	4	8	0	5	11
16	0	1	2	0	2	5	0	3	7	0	4	10	0	5	12
17	0	1	3	0	2	6	0	3	8	0	4	11	0	5	14
18	0	1	3	0	2	6	0	3	9	0	4	12	0	5	15
19	0	1	3	0	2	7	0	3	10	0	4	14	0	5	17
20	0	1	4	0	2	8	0	3	12	0	4	15	0	5	18
21	0	1	4	0	2	9	0	3	13	0	4	17	0	5	21
22	0	1	5	0	2	9	0	3	14	0	4	19	0	5	24
23	0	1	5	0	2	10	0	3	16	0	4	21	0	5	26
24	0	1	6	0	2	11	0	3	17	0	4	23	0	5	28
25	0	1	6	0	2	12	0	3	19	0	4	25	0	5	31
26	0	1	7	0	2	13	0	3	20	0	4	27	0	5	34
27	0	1	7	0	2	15	0	3	22	0	4	29	0	5	37
28	0	1	8	0	2	16	0	3	24	0	4	31	0	5	39
29	0	1	9	0	2	17	0	3	26	0	4	34	0	5	43
30	0	1	9	0	2	19	0	3	28	0	4	37	0	5	46
31	0	1	10	0	2	20	0	3	30	0	4	40	0	5	50
32	0	1	11	0	2	21	0	3	32	0	4	43	0	5	54
33	0	1	12	0	2	23	0	3	35	0	4	46	0	5	58
34	0	1	12	0	2	25	0	3	37	0	4	50	0	6	02

Parallel.	6 Miles.			7 Miles.			8 Miles.			9 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
0	0	6	0	0	7	0	0	8	0	0	9	0
1	0	6	0	0	7	0	0	8	0	0	9	0
2	0	6	0	0	7	0	0	8	0	0	9	1
3	0	6	0	0	7	1	0	8	1	0	9	1
4	0	6	1	0	7	1	0	8	1	0	9	1
5	0	6	1	0	7	2	0	8	2	0	9	2
6	0	6	2	0	7	2	0	8	3	0	9	3
7	0	6	3	0	7	3	0	8	4	0	9	4
8	0	6	3	0	7	4	0	8	4	0	9	5
9	0	6	4	0	7	5	0	8	6	0	9	6
10	0	6	6	0	7	7	0	8	7	0	9	8
11	0	6	7	0	7	8	0	8	9	0	9	10
12	0	6	8	0	7	9	0	8	11	0	9	12
13	0	6	9	0	7	11	0	8	12	0	9	14
14	0	6	11	0	7	13	0	8	15	0	9	16
15	0	6	13	0	7	15	0	8	17	0	9	19
16	0	6	14	0	7	17	0	8	19	0	9	22
17	0	6	16	0	7	19	0	8	22	0	9	25
18	0	6	18	0	7	21	0	8	25	0	9	28
19	0	6	20	0	7	24	0	8	28	0	9	31
20	0	6	22	0	7	25	0	8	29	0	9	34
21	0	6	26	0	7	30	0	8	34	0	9	38
22	0	6	28	0	7	33	0	8	38	0	9	42
23	0	6	31	0	7	37	0	8	41	0	9	47
24	0	6	33	0	7	39	0	8	44	0	9	50
25	0	6	37	0	7	43	0	8	50	0	9	56
26	0	6	40	0	7	47	0	8	54	0	10	01
27	0	6	42	0	7	51	0	9	59	0	10	06
28	0	6	47	0	7	55	0	9	03	0	10	11
29	0	6	52	0	8	00	0	9	09	0	10	17
30	0	6	56	0	8	05	0	9	14	0	10	24
31	0	7	00	0	8	10	0	9	20	9	10	30
32	0	7	04	0	8	15	0	9	26	0	10	37
33	0	7	09	0	8	21	0	9	32	0	10	44
34	0	7	14	0	8	27	0	9	39	0	10	51

Parallel.	1 Mile.			2 Miles.			3 Miles.			4 Miles.			5 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
35	0	1	13	0	2	26	0	3	40	0	4	53	0	6	6
36	0	1	14	0	2	28	0	3	42	0	4	57	0	6	11
37	0	1	15	0	2	30	0	3	45	0	5	01	0	6	16
38	0	1	16	0	2	32	0	3	48	0	5	05	0	6	21
39	0	1	17	0	2	34	0	3	52	0	5	09	0	6	26
40	0	1	18	0	2	37	0	3	55	0	5	13	0	6	32
41	0	1	19	0	2	39	0	3	58	0	5	18	0	6	37
42	0	1	21	0	2	41	0	4	02	0	5	23	0	6	44
43	0	1	22	0	2	44	0	4	06	0	5	28	0	6	50
44	0	1	23	0	2	47	0	4	10	0	5	34	0	6	57
45	0	1	25	0	2	50	0	4	15	0	5	39	0	7	4
46	0	1	26	0	2	53	0	4	19	0	5	45	0	7	12
47	0	1	28	0	2	56	0	4	24	0	5	52	0	7	20
48	0	1	30	0	2	59	0	4	29	0	5	59	0	7	28
49	0	1	31	0	3	03	0	4	34	0	6	06	0	7	37
50	0	1	33	0	3	07	0	4	40	0	6	13	0	7	47
51	0	1	35	0	3	11	0	4	46	0	6	21	0	7	57
52	0	1	37	0	3	14	0	4	52	0	6	30	0	8	07
53	0	1	40	0	3	19	0	4	59	0	6	38	0	8	18
54	0	1	42	0	3	24	0	5	06	0	6	48	0	8	30
55	0	1	45	0	3	29	0	5	14	0	[illegible]	[illegible]	0	8	43
56	0	1	47	0	3	35	0	5	22	0	[illegible]	[illegible]	0	8	56
57	0	1	50	0	3	40	0	5	30	0	7	21	0	9	11
58	0	1	53	0	3	46	0	5	40	0	7	33	0	9	26
59	0	1	56	0	3	53	0	5	49	0	7	46	0	9	42
60	0	2	00	0	4	00	0	6	00	0	8	00	0	10	00
61	0	2	04	0	4	07	0	6	11	0	8	15	0	10	19
62	0	2	08	0	4	16	0	6	23	0	8	31	0	10	39
63	0	2	12	0	4	24	0	6	36	0	8	49	0	11	01
64	0	2	17	0	4	34	0	6	51	0	9	07	0	11	24
65	0	2	22	0	4	44	0	7	06	0	9	28	0	11	50
66	0	2	28	0	4	45	0	7	23	0	9	50	0	12	18
67	0	2	33	0	5	06	0	7	39	0	10	12	0	12	45
68	0	2	40	0	5	27	0	8	14	0	11	01	0	13	48
69	0	2	47	0	5	34	0	8	21	0	11	08	0	13	55
70	0	2	55	0	5	50	0	8	45	0	11	40	0	14	35

Parallel.	6 Miles.			7 Miles.			8 Miles.			9 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
35	0	7	19	0	8	33	0	9	46	0	10	59
36	0	7	25	0	8	39	0	9	53	0	11	08
37	0	7	31	0	8	46	0	10	01	0	11	16
38	0	7	37	0	8	53	0	10	09	0	11	25
39	0	7	43	0	9	00	0	10	18	0	11	35
40	0	7	50	0	9	08	0	10	27	0	11	45
41	0	7	57	0	9	16	0	10	36	0	11	55
42	0	8	04	0	9	25	0	10	46	0	12	07
43	0	8	12	0	9	34	0	10	56	0	12	20
44	0	8	21	0	9	44	0	11	07	0	12	31
45	0	8	29	0	9	54	0	11	19	0	12	44
46	0	8	38	0	10	05	0	11	31	0	12	57
47	0	8	48	0	10	16	0	11	44	0	13	12
48	0	8	58	0	10	28	0	11	57	0	13	27
49	0	9	08	0	10	40	0	11	12	0	13	43
50	0	9	20	0	10	53	0	12	27	0	14	00
51	0	9	22	0	10	57	0	12	33	0	14	08
52	0	9	44	0	11	22	0	13	00	0	14	37
53	0	9	58	0	11	38	0	13	18	0	14	57
54	0	10	12	0	11	55	0	13	36	0	15	19
55	0	10	28	0	12	12	0	13	57	0	15	41
56	0	10	44	0	12	31	0	14	18	0	16	06
57	0	11	01	0	12	51	0	14	41	0	16	31
58	0	11	19	0	13	13	0	15	06	0	16	59
59	0	11	39	0	13	35	0	15	32	0	17	28
60	0	12	00	0	14	00	0	16	00	0	18	00
61	0	12	22	0	14	26	0	16	30	0	18	33
62	0	12	47	0	14	55	0	17	02	0	19	10
63	0	13	13	0	15	25	0	17	37	0	19	49
64	0	13	41	0	15	58	0	18	15	0	20	32
65	0	14	12	0	16	34	0	18	55	0	21	18
66	0	14	45	0	17	12	0	19	40	0	22	08
67	0	15	18	0	17	51	0	20	24	0	22	57
68	0	16	25	0	19	22	0	22	09	0	23	56
69	0	16	42	0	19	29	0	22	16	0	25	03
70	0	17	30	0	20	25	0	23	20	0	26	13

Parallel.	10 Miles.			20 Miles.			30 Miles.			40 Miles.			50 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
0	0	10	0	0	20	0	0	30	0	0	40	0	0	50	0
1	0	10	0	0	20	0	0	30	0	0	40	0	0	50	0
2	0	10	1	0	20	1	0	30	1	0	40	1	0	50	1
3	0	10	1	0	20	2	0	30	2	0	40	3	0	50	4
4	0	10	1	0	20	3	0	30	4	0	40	6	0	50	7
5	0	10	2	0	20	5	0	30	7	0	40	9	0	50	11
6	0	10	3	0	20	6	0	30	9	0	40	13	0	50	16
7	0	10	4	0	20	9	0	30	13	0	40	18	0	50	22
8	0	10	6	0	20	1	0	30	17	0	40	23	0	50	28
9	0	10	7	0	20	5	0	30	22	0	40	30	0	50	37
10	0	10	9	0	20	18	0	30	28	0	40	37	0	50	46
11	0	10	11	0	20	22	0	30	34	0	40	45	0	50	56
12	0	10	13	0	20	27	0	30	40	0	40	53	0	51	06
13	0	10	16	0	20	32	0	30	47	0	41	03	0	51	19
14	0	10	18	0	20	37	0	30	55	0	41	13	0	51	31
15	0	10	21	0	20	42	0	31	03	0	41	24	0	51	46
16	0	10	24	0	20	49	0	31	13	0	41	37	0	52	01
17	0	10	27	0	20	55	0	31	21	0	41	49	0	52	16
18	0	10	31	0	21	02	0	31	33	0	42	04	0	52	34
19	0	10	34	0	21	09	0	31	44	0	42	18	0	52	53
20	0	10	38	0	21	17	0	31	55	0	42	34	0	53	12
21	0	10	43	0	21	25	0	32	08	0	42	51	0	53	33
22	0	10	47	0	21	34	0	32	21	0	43	09	0	53	56
23	0	10	52	0	21	44	0	32	35	0	43	27	0	54	19
24	0	10	57	0	21	54	0	32	50	0	43	47	0	54	44
25	0	11	02	0	22	04	0	33	06	0	44	08	0	55	10
26	0	11	07	0	22	15	0	33	22	0	44	30	0	55	37
27	0	11	13	0	22	27	0	33	40	0	44	53	0	56	07
28	0	11	19	0	22	37	0	33	56	0	45	16	0	56	35
29	0	11	26	0	22	52	0	34	18	0	45	44	0	57	10
30	0	11	33	0	23	06	0	34	38	0	46	11	0	57	44
31	0	11	40	0	23	19	0	34	58	0	46	38	0	58	18
32	0	11	47	0	23	35	0	35	22	0	47	10	0	58	57
33	0	11	55	0	23	50	0	35	46	0	47	41	0	59	37
34	0	12	04	0	24	08	0	36	11	0	48	15	1	00	19

Parallel.	60 Miles.			70 Miles.			80 Miles.			90 Miles.			100 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
0	1	0	0	1	10	00	1	20	00	1	30	00	1	40	00
1	1	0	1	1	10	01	1	20	01	1	30	00	1	40	01
2	1	0	2	1	10	03	1	20	03	1	30	03	1	40	04
3	1	0	5	1	10	06	1	20	07	1	30	07	1	40	08
4	1	0	9	1	10	10	1	20	12	1	30	13	1	40	14
5	1	0	14	1	10	16	1	20	18	1	30	21	1	40	23
6	1	0	19	1	10	21	1	20	24	1	30	27	1	40	31
7	1	0	27	1	10	31	1	20	35	1	30	39	1	40	45
8	1	0	34	1	10	40	1	20	46	1	30	52	1	40	59
9	1	0	45	1	10	52	1	20	59	1	31	07	1	41	15
10	1	0	55	1	11	05	1	21	14	1	31	23	1	41	34
11	1	1	07	1	11	19	1	21	30	1	31	41	1	41	52
12	1	1	20	1	11	33	1	21	46	1	31	60	1	42	13
13	1	1	35	1	11	50	1	22	06	1	32	22	1	42	38
14	1	1	50	1	12	09	1	22	27	1	32	45	1	43	04
15	1	2	07	1	12	28	1	22	49	1	33	10	1	43	32
16	1	2	26	1	12	50	1	23	14	1	33	39	1	44	03
17	1	2	43	1	13	11	1	23	38	1	34	06	1	44	34
18	1	3	05	1	13	36	1	24	07	1	34	38	1	45	08
19	1	3	27	1	14	01	1	24	37	1	35	11	1	45	46
20	1	3	51	1	14	29	1	25	08	1	35	46	1	46	20
21	1	4	16	1	14	59	1	25	41	1	36	24	1	47	06
22	1	4	43	1	15	30	1	26	17	1	37	04	1	47	52
23	1	5	11	1	16	03	1	26	55	1	37	46	1	48	38
24	1	5	41	1	16	37	1	27	34	1	38	31	1	49	27
25	1	6	12	1	17	14	1	28	18	1	39	20	1	50	22
26	1	6	44	1	17	51	1	28	58	1	40	05	1	51	13
27	1	7	20	1	18	33	1	29	47	1	41	00	1	52	13
28	1	7	55	1	19	14	1	30	34	1	41	53	1	53	15
29	1	8	36	1	20	02	1	31	28	1	42	54	1	54	20
30	1	9	17	1	20	49	1	32	23	1	44	55	1	55	28
31	1	9	58	1	21	37	1	33	18	1	44	57	1	56	38
32	1	10	45	1	22	32	1	34	20	1	46	07	1	57	55
33	1	11	42	1	23	37	1	35	33	1	47	28	1	59	13
34	1	12	23	1	24	26	1	36	31	1	48	34	2	00	38

Parallel.	10 Miles.			20 Miles.			30 Miles.			40 Miles.			50 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
35	0	12	12	0	24	25	0	36	37	0	48	50	1	1	02
36	0	12	22	0	24	43	0	37	05	0	49	27	1	1	48
37	0	12	31	0	25	03	0	37	34	0	50	05	1	2	37
38	0	12	41	0	25	23	0	38	04	0	50	45	1	3	27
39	0	12	52	0	25	44	0	38	36	0	51	28	1	4	20
40	0	13	03	0	26	06	0	39	09	0	52	13	1	5	16
41	0	13	15	0	26	30	0	39	45	0	53	00	1	6	15
42	0	13	27	0	26	55	0	40	22	0	53	49	1	7	17
43	0	13	42	0	27	25	0	41	17	0	54	49	1	8	32
44	0	13	54	0	27	48	0	41	42	0	55	37	1	9	30
45	0	14	08	0	28	16	0	42	24	0	56	33	1	10	41
46	0	14	24	0	28	47	0	43	11	0	57	39	1	11	58
47	0	14	40	0	29	20	0	43	59	0	58	34	1	13	19
48	0	14	57	0	29	53	0	44	50	0	59	47	1	14	43
49	0	15	14	0	30	29	0	45	33	1	0	57	1	16	11
50	0	15	33	0	31	07	0	46	40	1	2	14	1	17	47
51	0	15	53	0	31	47	0	47	40	1	3	33	1	19	27
52	0	16	14	0	32	29	0	48	43	1	4	58	1	21	12
53	0	16	37	0	33	14	0	49	51	1	6	28	1	23	05
54	0	17	01	0	34	02	0	51	02	1	8	03	1	25	04
55	0	17	26	0	34	52	0	52	18	1	9	48	1	27	10
56	0	17	53	0	35	46	0	53	39	1	11	32	1	29	25
57	0	18	21	0	36	43	0	55	05	1	13	27	1	31	48
58	0	18	52	0	37	44	0	56	36	1	15	29	1	34	21
59	0	19	24	0	38	50	0	58	14	1	17	39	1	37	04
60	0	20	00	0	40	00	1	0	00	1	20	00	1	40	00
61	0	20	37	0	41	15	1	1	52	1	22	30	1	43	07
62	0	21	18	0	42	36	1	3	54	1	25	12	1	46	30
63	0	22	12	0	44	03	1	6	05	1	28	07	1	50	08
64	0	22	48	0	45	37	1	8	16	1	31	15	1	54	03
65	0	23	40	0	47	09	1	10	49	1	34	29	1	58	08
66	0	24	35	0	49	10	1	13	45	1	38	21	2	02	56
67	0	25	35	0	51	10	1	16	45	1	42	20	2	07	55
68	0	26	42	0	53	24	1	20	06	1	46	48	2	13	30
69	0	27	54	0	55	45	1	23	42	1	51	36	2	19	30
70	0	29	14	0	59	28	1	27	42	1	56	56	2	26	10

Parallel.	60 Miles.			70 Miles.			80 Miles.			90 Miles.			100 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
35	1	13	14	1	25	26	1	37	38	1	49	50	2	2	05
36	1	14	10	1	26	32	1	38	53	1	51	15	2	3	36
37	1	13	08	1	27	39	1	40	11	1	52	41	2	5	13
38	1	16	08	1	28	49	1	41	31	1	54	12	2	6	53
39	1	17	12	1	30	04	1	42	56	1	55	48	2	8	40
40	1	18	19	1	31	22	1	44	25	1	57	28	2	10	32
41	1	19	30	1	32	45	1	46	00	1	59	15	2	12	30
42	1	20	44	1	34	11	1	47	38	2	01	06	2	14	33
43	1	22	14	1	35	56	1	49	39	2	03	21	2	17	03
44	1	23	25	1	37	19	1	51	13	2	05	07	2	19	02
45	1	24	50	1	38	58	1	53	07	2	07	19	2	21	25
46	1	26	22	1	40	45	1	55	09	2	10	32	2	23	55
47	1	27	59	1	42	38	1	57	18	2	11	58	2	26	38
48	1	29	40	1	44	36	1	59	33	2	14	30	2	29	27
49	1	31	26	1	46	40	2	01	54	2	17	08	2	32	25
50	1	33	21	1	48	54	2	04	28	2	20	01	2	35	35
51	1	35	20	1	51	13	2	07	07	2	23	00	2	38	53
52	1	37	27	1	53	41	2	09	55	2	26	09	2	42	20
53	1	39	42	1	56	19	2	12	56	2	29	33	2	46	15
54	1	42	05	1	59	06	2	16	07	2	33	07	2	50	08
55	1	44	36	2	02	02	2	19	28	2	36	54	2	54	20
56	1	47	18	2	05	11	2	23	04	2	41	57	2	58	50
57	1	50	10	2	08	32	2	26	53	2	45	15	2	03	36
58	1	53	13	2	12	05	2	30	57	2	49	49	3	08	43
59	1	56	29	2	15	54	2	35	19	2	54	43	3	14	08
60	2	00	00	2	20	00	2	40	00	3	00	00	3	20	00
61	2	03	45	2	24	22	2	45	40	3	05	37	3	26	15
62	2	07	48	2	29	06	2	50	24	3	11	42	3	33	00
63	2	12	10	2	34	12	2	56	13	3	18	15	3	40	16
64	2	16	52	2	39	41	3	02	29	3	25	18	3	48	06
65	2	21	47	2	45	27	3	09	06	3	32	46	3	56	37
66	2	27	21	2	51	56	3	16	31	3	41	07	4	05	41
67	2	33	30	2	59	05	3	24	40	3	50	15	4	15	50
68	2	40	12	2	06	54	3	33	36	4	00	18	4	27	00
69	2	47	14	2	15	18	3	43	12	4	11	16	4	39	30
70	2	55	24	2	24	38	3	53	52	4	23	06	4	52	20

Parallel.	200 Miles.			300 Miles.			400 Miles.			500 Miles.			600 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
0	3	20	00	5	0	00	6	40	00	8	20	00	10	0	00
1	3	20	02	5	0	03	6	40	04	8	20	04	10	0	05
2	3	20	07	5	0	11	6	40	14	8	20	18	10	0	22
3	3	20	17	5	0	25	6	40	33	8	20	45	10	0	53
4	3	20	29	5	0	44	6	40	59	8	20	13	10	1	27
5	3	20	46	5	1	09	6	41	32	8	21	55	10	2	18
6	3	21	03	5	1	35	6	42	07	8	22	39	10	3	11
7	3	21	30	5	2	15	6	43	00	8	23	45	10	4	30
8	3	21	58	5	2	57	6	43	56	8	24	55	10	5	54
9	3	22	29	5	3	44	6	44	59	8	26	14	10	7	29
10	3	23	06	5	4	39	6	46	12	8	27	45	10	9	18
11	3	23	44	5	5	36	6	47	28	8	29	20	10	11	12
12	3	24	26	5	6	49	6	49	02	8	31	15	10	13	28
13	3	25	16	5	7	54	6	50	32	8	33	10	10	15	48
14	3	26	08	5	9	12	6	52	16	8	35	20	10	18	24
15	3	27	04	5	10	36	6	54	08	8	37	40	10	21	12
16	3	28	06	5	12	09	6	56	12	8	40	15	10	24	18
17	3	29	08	5	13	42	6	58	26	8	43	00	10	27	34
18	3	30	18	5	15	27	7	00	36	8	45	45	10	30	56
19	3	31	32	5	17	18	7	03	04	8	48	50	10	34	36
20	3	32	40	5	19	00	7	05	20	8	51	40	10	38	00
21	3	34	12	5	21	18	7	08	24	8	55	30	10	42	36
22	3	35	44	5	23	36	7	11	28	8	59	20	10	47	12
23	3	37	16	5	27	54	7	16	32	9	05	10	10	53	48
24	3	38	54	5	28	21	7	17	48	9	07	15	10	56	42
25	3	40	44	5	31	06	7	21	28	9	11	50	11	02	12
26	3	42	26	5	33	39	7	24	52	9	16	05	11	07	18
27	3	44	26	5	36	39	7	28	52	9	21	05	11	13	18
28	3	46	30	5	39	45	7	33	00	9	26	15	11	19	30
29	3	48	40	5	43	00	7	37	20	9	31	40	11	26	00
30	3	50	56	5	46	24	7	41	52	9	37	20	11	32	48
31	3	33	16	5	49	54	7	45	32	9	42	10	11	38	48
32	3	55	50	5	53	45	7	51	40	9	49	35	11	47	20
33	3	58	26	5	57	39	7	56	52	9	56	05	11	55	18
34	4	01	16	6	01	54	8	02	32	10	03	10	12	03	48

Parallel.	700 Miles.			800 Miles.			900 Miles.			1000 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
0	11	40	00	13	20	00	15	0	00	16	40	00
1	11	40	06	13	20	07	15	0	09	16	40	10
2	11	40	26	13	20	30	15	0	34	16	40	38
3	11	41	00	13	21	08	15	1	17	16	41	25
4	11	41	41	13	21	55	15	2	19	16	42	23
5	11	42	41	13	23	04	15	3	27	16	43	48
6	11	43	43	13	24	15	15	4	47	16	45	18
7	11	45	15	13	26	00	15	6	45	16	47	30
8	11	46	53	13	27	52	15	8	51	16	49	50
9	11	48	44	13	29	59	15	11	14	16	52	27
10	11	50	51	13	32	24	15	13	57	16	55	37
11	11	53	04	13	34	56	15	16	48	16	58	42
12	11	55	41	13	37	54	15	20	07	17	02	10
13	11	57	26	13	40	04	15	22	42	17	04	18
14	12	01	28	13	44	32	15	27	36	17	10	36
15	12	04	44	13	48	16	15	31	48	17	15	17
16	12	08	21	13	52	24	15	36	27	17	20	31
17	12	12	08	13	56	42	15	41	16	17	25	41
18	12	16	05	14	01	14	15	46	23	17	31	27
19	12	20	22	14	06	08	15	51	05	17	37	37
20	12	24	20	14	10	40	15	57	00	17	43	20
21	12	29	42	14	16	48	16	03	54	17	50	00
22	12	35	04	14	22	56	16	10	48	17	58	31
23	12	42	26	14	31	04	16	19	42	18	08	20
24	12	46	09	14	35	36	16	25	30	18	14	30
25	12	52	34	14	42	56	16	33	18	18	23	40
26	12	58	38	14	49	44	16	40	57	18	32	10
27	13	05	31	14	57	44	16	49	57	18	42	13
28	13	12	45	15	06	00	16	59	15	18	53	30
29	13	20	20	15	14	40	17	09	00	19	03	20
30	13	28	16	15	23	44	17	19	12	19	14	43
31	13	35	26	15	32	04	17	29	42	19	26	23
32	13	45	15	15	43	10	17	41	05	19	39	10
33	13	54	31	15	53	44	17	52	57	19	52	13
34	14	04	26	16	05	04	18	05	42	20	06	23

Parallel.	200 Miles.			300 Miles.			400 Miles.			500 Miles.			600 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
35	4	04	10	6	06	15	8	08	20	10	10	25	12	12	30
36	4	07	14	6	10	51	8	14	28	10	18	05	12	21	42
37	4	10	26	6	15	39	8	20	52	10	26	05	12	31	18
38	4	13	46	6	20	39	8	27	32	10	34	25	12	41	18
39	4	17	20	6	26	00	8	34	40	10	43	20	12	52	00
40	4	21	4	6	31	36	8	42	03	10	52	40	13	03	12
41	4	25	0	6	37	30	8	50	00	11	02	30	13	15	00
42	4	29	8	6	43	42	8	58	16	11	12	50	13	27	24
43	4	34	6	6	51	09	9	03	12	11	25	15	13	42	18
44	4	38	4	6	57	06	9	16	03	11	35	10	13	54	12
45	4	42	50	7	04	15	9	25	40	11	47	05	14	08	30
46	4	47	52	7	11	48	9	35	44	11	59	40	14	23	36
47	4	53	16	7	19	54	9	46	32	12	13	10	14	39	48
48	4	58	54	7	28	21	9	57	48	12	27	15	14	56	42
49	5	04	50	7	37	15	10	09	40	12	42	05	14	14	30
50	5	11	10	7	46	45	10	22	20	12	57	55	15	33	20
51	5	17	46	7	56	39	10	35	22	13	14	15	15	53	08
52	5	24	50	8	07	15	10	49	40	13	32	05	16	14	30
53	5	32	20	8	18	30	11	04	40	13	50	50	16	37	00
54	5	40	16	8	30	24	11	20	32	14	10	40	17	00	43
55	5	48	40	8	43	30	11	37	20	14	31	55	17	26	00
56	5	57	40	8	56	30	11	55	20	14	54	15	17	53	00
57	6	07	14	9	10	91	12	14	28	15	18	05	18	21	42
58	6	17	26	9	26	09	12	34	52	15	43	35	18	52	18
59	6	28	16	9	42	25	12	56	33	16	10	40	19	24	50
60	6	40	00	10	00	00	13	20	00	16	40	00	20	00	00
61	6	52	30	10	18	45	13	45	00	17	11	15	20	37	30
62	7	06	00	10	39	00	14	12	00	17	45	00	21	18	00
63	7	20	32	11	00	48	14	41	04	18	21	20	22	01	36
64	7	36	12	11	24	18	15	12	24	19	00	30	22	48	36
65	7	53	13	11	49	48	15	46	24	19	43	00	23	39	36
66	8	11	22	12	17	03	16	22	44	20	28	25	24	34	06
67	8	31	40	12	47	30	17	03	20	21	19	10	25	35	00
68	8	54	00	13	21	00	17	48	00	22	15	00	26	42	00
69	9	18	00	13	57	00	18	36	00	23	15	00	27	54	00
70	9	44	40	14	37	00	19	29	20	24	21	00	29	14	00

Parallel.	700 Miles.			800 Miles.			900 Miles.			1000 Miles.		
	D.	M.	S.	D.	M.	S.	D.	M.	S.	D.	M.	S.
35	14	14	35	16	16	40	18	18	45	20	20	50
36	14	25	19	16	28	56	18	32	33	20	36	10
37	14	36	31	16	41	44	18	46	57	20	53	[illegible]
38	14	48	11	16	55	04	19	01	57	21	[illegible]	30
39	15	00	40	17	09	20	19	08	00	[illegible]	26	40
40	15	13	44	17	24	16	19	34	48	21	45	26
41	15	27	30	17	40	00	19	52	30	22	05	00
42	15	41	58	17	56	22	20	10	56	22	25	30
43	15	59	21	18	16	24	20	33	27	22	50	13
44	16	13	14	18	32	16	20	51	[illegible]	23	10	20
45	16	29	55	18	51	20	21	12	45	23	34	10
46	16	47	32	19	11	28	21	35	24	23	59	10
47	17	06	26	19	33	04	21	59	42	24	26	10
48	17	26	09	19	55	36	22	25	03	24	54	26
49	17	46	55	20	19	20	22	51	45	25	24	10
50	18	08	55	20	44	30	23	20	05	25	55	50
51	18	32	01	21	10	54	23	49	47	26	28	53
52	18	57	15	21	39	30	24	21	55	27	04	20
53	19	23	10	22	09	20	24	55	30	27	41	40
54	19	50	56	22	41	04	25	31	12	28	21	20
55	20	20	20	23	14	40	26	09	00	29	03	20
56	20	51	50	23	50	40	26	49	30	29	48	20
57	21	25	19	24	28	56	27	32	23	30	36	00
58	22	01	01	25	09	44	28	18	27	31	27	10
59	22	38	58	25	53	06	29	07	15	32	21	23
60	23	20	00	26	40	00	30	00	00	33	20	00
61	24	03	45	27	30	00	30	56	15	34	22	30
62	24	51	00	28	24	00	31	57	00	35	30	00
63	25	41	52	29	29	08	33	02	24	36	42	40
64	26	36	42	30	24	48	34	12	54	38	06	00
65	27	36	12	31	32	58	35	29	24	39	26	00
66	28	39	47	32	45	28	36	51	09	40	56	50
67	29	50	50	34	06	40	38	22	30	42	38	20
68	31	09	00	35	36	00	40	03	00	44	30	00
69	32	33	00	37	12	00	41	51	00	46	30	00
70	34	06	24	38	57	40	43	51	00	48	43	20

LOXODROMIQUES, *or* MILES, *with the Difference of*

Latitude		*1 Rumb, 11° 15′.*			*2 Rumb, 22° 30′.*			*3 Rumb, 33° 45′.*			*4 Rumb, 45° 00′.*		
		Longitude		*Dist. in Miles.*	*Longitude*		*Dist. in Miles.*	*Longitude*		*Dist. in Miles.*	*Longitude*		*Dist. in Miles.*
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	10	0	2	10	0	4	11	0	7	12	0	10	14
0	20	0	4	20	0	8	22	0	13	25	0	20	28
0	30	0	6	31	0	12	32	0	20	36	0	30	42
0	40	0	8	41	0	16	43	0	27	48	0	40	57
0	50	0	10	51	0	20	54	0	33	60	0	50	71
1	0	0	12	61	0	24	65	0	40	72	1	0	85
1	10	0	14	71	0	29	76	0	47	84	1	10	99
1	20	0	16	82	0	33	87	0	53	96	1	20	113
1	30	0	18	92	0	37	197	1	00	100	1	30	127
1	40	0	20	102	0	41	108	1	07	110	1	40	141
1	50	0	22	112	0	45	119	1	13	122	1	50	156
2	0	0	24	122	0	49	130	1	20	144	2	0	170
2	10	0	26	133	0	53	141	1	27	156	2	00	184
2	20	0	28	143	0	57	152	1	33	168	2	10	198
2	30	0	30	153	1	02	162	1	40	180	2	20	212
2	40	0	32	163	1	06	173	1	47	192	2	30	226
2	50	0	34	173	1	10	184	1	53	204	2	40	240
3	0	0	36	184	1	15	194	2	00	216	3	0	255
3	10	0	38	194	1	19	206	2	07	229	3	10	269
3	20	0	40	204	1	23	216	2	13	241	3	20	283
3	30	0	42	214	1	27	227	2	20	253	3	30	297
3	40	0	44	224	1	32	238	2	27	265	3	40	311
3	50	0	46	234	1	36	249	2	33	277	3	50	325
4	0	0	48	245	1	39	260	2	40	289	4	0	339
4	10	0	50	255	1	44	271	2	47	301	4	10	344
4	20	0	52	265	1	48	281	2	54	313	4	20	358
4	30	0	54	275	1	52	292	3	01	325	4	30	372
4	40	0	56	285	1	56	303	3	07	337	4	40	386
4	50	0	58	296	2	00	314	3	14	349	4	50	390
5	0	1	0	306	2	04	325	3	20	361	5	0	424
5	10	1	2	316	2	08	336	3	27	373	5	10	438
5	20	1	4	326	2	12	346	3	34	385	5	20	453
5	30	1	6	336	2	16	357	3	40	397	5	30	467
5	40	1	8	347	2	20	368	3	47	409	5	40	481
5	50	1	10	357	2	24	378	3	54	421	5	50	495

TRAVERSE-TABLES *of* Longitudes *and* Latitudes.

Latitude.		*5 Rumb, 56° 15′.*			*6 Rumb, 67° 30′.*			*7 Rumb, 78° 45′.*		
		Longitude.		*Dist. in Miles.*	*Longitude.*		*Dist. in Miles.*	*Longitude.*		*Dist. in Miles.*
D.	M.	D.	M.		D.	M.		D.	M.	
0	0	0	0	0	0	0	0	0	0	0
0	10	0	15	18	0	24	26	0	51	51
0	20	0	30	36	0	48	52	1	38	103
0	30	0	45	54	1	12	78	2	29	154
0	40	1	00	72	1	36	105	3	20	205
0	50	1	15	90	2	00	131	4	11	256
1	0	1	30	108	2	24	157	5	02	308
1	10	1	45	126	2	49	183	5	53	359
1	20	2	00	144	3	12	299	6	44	410
1	30	2	15	162	3	38	235	7	35	461
1	40	2	30	180	4	02	261	8	22	513
1	50	2	45	198	4	26	287	9	13	564
2	0	3	00	216	4	50	314	10	04	615
2	10	3	15	234	5	14	340	10	55	666
2	20	3	30	252	5	38	366	11	42	718
2	30	3	45	270	6	02	392	12	33	769
2	40	4	00	288	6	25	418	13	24	820
2	50	4	15	309	6	50	444	14	16	871
3	0	4	30	324	7	14	470	15	07	923
3	10	4	45	342	7	38	496	15	54	974
3	20	5	00	360	8	02	523	16	49	1025
3	30	5	15	378	8	26	549	17	36	1076
3	40	5	30	396	8	52	575	18	27	1128
3	50	5	45	414	9	15	601	19	18	1179
4	0	6	00	432	9	39	627	20	09	1230
4	10	6	15	450	10	04	653	21	00	1281
4	20	6	30	468	10	29	679	21	48	1333
4	30	6	45	486	10	53	706	22	39	1384
4	40	7	00	504	11	17	732	23	30	1435
4	50	7	15	522	11	40	758	24	21	1487
5	0	7	30	540	12	05	784	25	08	1538
5	10	7	45	558	12	29	810	26	03	1589
5	20	8	00	576	12	53	836	26	51	1640
5	30	8	15	594	13	17	862	27	42	1642
5	40	8	30	612	13	42	888	28	33	1743
5	50	8	45	630	14	06	915	29	[illegible]	1794

Latitude		1 Rumb, 11° 15′.			2 Rumb, 22° 30′.			3 Rumb, 33° 45′.			4 Rumb, 45° 00′.		
		Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
6	0	1	12	367	2	28	390	4	01	433	6	0	509
6	10	1	14	377	2	33	401	4	07	445	6	10	523
6	20	1	16	387	2	37	411	4	14	457	6	20	537
6	30	1	18	398	2	41	422	4	21	469	6	30	552
6	40	1	20	408	2	45	433	4	27	481	6	40	536
6	50	1	22	418	2	50	443	4	34	493	6	50	580
7	0	1	24	428	2	54	455	4	41	505	7	0	594
7	10	1	26	438	2	58	465	4	47	517	7	11	608
7	20	1	28	449	3	02	476	4	54	529	7	20	622
7	30	1	30	459	3	06	487	5	01	541	7	31	636
7	40	1	32	469	3	11	498	5	08	553	7	41	651
7	50	1	34	479	3	15	509	5	14	565	7	51	665
8	0	1	36	480	3	19	520	5	21	577	8	2	679
8	10	1	38	500	3	24	530	5	28	589	8	12	693
8	20	1	40	510	3	28	541	5	35	601	8	22	707
8	30	1	42	520	3	32	552	5	41	613	8	32	721
8	40	1	44	530	3	36	563	5	48	625	8	42	735
8	50	1	46	540	3	40	574	5	55	637	8	52	749
9	0	1	48	558	3	44	584	6	02	649	9	1	764
9	10	1	50	561	3	49	595	6	08	661	9	12	778
9	20	1	52	571	3	53	606	6	15	673	9	22	792
9	30	1	54	581	3	57	617	6	22	686	9	33	805
9	40	1	56	591	4	01	628	6	29	698	9	42	820
9	50	1	58	602	4	05	638	6	35	709	9	52	834
10	0	2	0	612	4	10	649	6	42	722	10	3	849
10	10	2	2	622	4	14	660	6	49	734	10	13	863
10	20	2	4	632	4	18	671	6	56	746	10	23	877
10	30	2	6	642	4	22	682	7	01	758	10	33	891
10	40	2	8	653	4	26	693	7	09	770	10	44	905
10	50	2	10	663	4	30	704	7	16	782	10	54	919
11	0	2	12	673	4	34	714	7	23	794	11	4	933
11	10	2	14	683	4	38	725	7	30	806	11	14	948
11	20	2	16	693	4	42	732	7	36	818	11	24	956
11	30	2	18	704	4	48	747	7	44	830	11	34	966
11	40	2	20	714	4	54	758	7	51	842	11	44	980
11	50	2	22	724	4	50	768	7	58	854	11	55	994

Latitude.		5 Rumb, 56° 15′.			6 Rumb, 67° 30′.			7 Rumb, 78° 45′.		
		Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.	
6	0	9	0	648	14	30	941	30	14	1843
6	10	9	15	666	14	55	969	31	03	1897
6	20	9	30	684	15	19	993	31	54	1948
6	30	9	45	702	15	44	1019	32	46	1999
6	40	10	00	720	16	08	1045	33	37	2050
6	50	10	15	738	16	33	1071	34	25	2102
7	0	10	30	756	16	57	1098	35	18	2153
7	10	10	45	774	17	21	1124	36	07	2204
7	20	11	00	792	17	45	1150	37	00	2255
7	30	11	16	810	18	10	1176	38	00	2307
7	40	11	32	828	18	34	1202	38	42	2368
7	50	11	46	846	18	58	1228	39	29	2409
8	0	12	01	864	19	22	1254	40	21	2460
8	10	12	16	882	19	47	1280	40	12	2512
8	20	12	31	900	20	11	1307	42	04	2563
8	30	12	47	918	20	35	1333	42	51	2614
8	40	13	02	936	21	00	1359	43	43	2665
8	50	13	17	954	21	24	1385	44	34	2717
9	0	13	32	972	21	50	1411	45	26	2768
9	10	13	47	990	22	14	1437	46	18	2819
9	20	14	02	1008	22	39	1463	47	09	2870
9	30	14	16	1026	23	03	1489	47	57	2922
9	40	14	32	1044	23	27	1516	48	40	2973
9	50	14	48	1062	23	52	1542	49	41	3024
10	0	15	03	1080	24	16	1568	50	32	3075
10	10	15	17	1098	24	41	1594	51	24	3127
10	20	15	33	1116	25	05	1620	52	16	3178
10	30	15	47	1134	25	30	1646	52	04	3229
10	40	16	03	1152	25	54	1662	53	56	3271
10	50	16	18	1170	26	18	1689	54	48	3322
11	0	16	34	1188	26	43	1725	55	36	3373
11	10	16	49	1206	27	08	1751	56	28	3424
11	20	17	05	1224	27	32	1777	57	20	3476
11	30	17	19	1242	27	58	1803	58	12	3527
11	40	17	35	1260	28	22	1829	59	41	3578
11	50	17	50	1278	28	47	1855	59	56	3636

Latitude		1 Rumb, 11° 15'.			2 Rumb, 22° 30'.			3 Rumb, 33° 45'.			4 Rumb, 45° 00'.		
		Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
12	0	2	24	734	5	2	779	8	4	866	12	5	1018
12	10	2	26	744	5	5	790	8	11	878	12	15	1032
12	20	2	28	755	5	9	801	8	18	890	12	26	1047
12	30	2	30	765	5	13	812	8	25	902	12	35	1061
12	40	2	32	775	5	17	823	8	32	914	12	46	1075
12	50	2	34	785	5	21	833	8	39	926	12	56	1089
13	0	2	36	795	5	26	844	8	46	938	13	6	1103
13	10	2	38	805	5	30	855	8	52	950	13	17	1117
13	20	2	40	816	5	34	866	8	59	962	13	28	1131
13	30	2	43	826	5	38	877	9	06	974	13	38	1146
13	40	2	45	836	5	43	887	9	14	986	13	48	1160
13	50	2	47	846	5	47	898	9	21	998	13	58	1174
14	0	2	49	856	5	51	909	9	28	1010	14	8	1188
14	10	2	51	867	5	55	920	9	34	1022	14	18	1202
14	20	2	53	877	6	00	931	9	41	1034	14	20	1216
14	30	2	55	887	6	04	942	9	47	1046	14	30	1230
14	40	2	57	897	6	08	952	9	54	1058	14	49	1244
14	50	2	59	907	6	13	963	10	01	1070	14	59	1259
15	0	3	1	918	6	17	974	10	08	1082	15	10	1272
15	10	3	3	928	6	21	985	10	15	1094	15	21	1281
15	20	3	6	938	6	26	996	10	22	1106	15	31	1301
15	30	3	8	948	6	30	1007	10	30	1118	15	41	1315
15	40	3	10	958	6	34	1017	10	37	1131	15	51	1329
15	50	3	12	969	6	39	1028	10	44	1143	16	1	1343
16	0	3	14	979	6	43	1039	10	50	1155	16	12	1358
16	10	3	16	989	6	47	1050	10	56	1167	16	23	1372
16	20	3	18	999	6	51	1061	11	03	1179	16	33	1386
16	30	3	20	1009	6	55	1072	11	10	1191	16	44	1400
16	40	3	22	1029	6	59	1082	11	17	1203	16	55	1414
16	50	3	24	1039	7	04	1093	11	24	1215	17	5	1428
17	0	3	26	1040	7	09	1104	11	31	1227	17	15	1442
17	10	3	28	1050	7	13	1115	11	39	1239	17	25	1457
17	20	3	30	1060	7	17	1126	11	46	1251	17	36	1471
17	30	3	32	1070	7	21	1136	11	53	1263	17	47	1485
17	40	3	34	1081	7	26	1147	12	00	1275	17	57	1499
17	50	3	30	1091	7	30	1158	12	07	1287	18	8	1513

Latitude.		5 Rumb, 56° 15'.			6 Rumb, 67° 30'.			7 Rumb, 78° 45'.		
		Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.	
12	0	18	05	1296	29	12	1881	60	48	3691
12	10	18	20	1314	29	36	1908	61	36	3742
12	20	18	36	1332	30	00	1934	62	28	3793
12	30	18	51	1350	30	25	1960	63	20	3844
12	40	19	07	1368	30	50	1986	64	12	3896
12	50	19	22	1386	31	15	2012	65	05	3947
13	0	19	38	1404	31	39	2038	65	55	3998
13	10	19	52	1422	32	04	2064	66	46	4049
13	20	20	08	1440	32	29	2090	67	38	4101
13	30	20	34	1458	32	53	2117	68	30	4152
13	40	20	39	1476	33	18	2143	69	23	4203
13	50	20	54	1494	33	43	2169	70	15	4252
14	0	21	10	1512	34	10	2195	71	08	4306
14	10	21	25	1530	34	34	2221	71	57	4357
14	20	21	40	1548	34	59	2247	72	49	4408
14	30	21	55	1566	35	24	2273	73	42	4459
14	40	22	11	1584	35	49	2300	74	34	4511
14	50	22	26	1592	36	13	2326	75	23	4562
15	0	22	43	1620	36	38	2352	76	16	4613
15	10	22	57	1638	37	03	2378	77	09	4664
15	20	23	14	1656	37	28	2404	78	02	4716
15	30	23	28	1674	37	52	2430	78	55	4767
15	40	23	44	1692	38	13	2456	79	47	4818
15	50	24	04	1710	38	42	2482	80	38	4870
16	0	24	16	1728	39	08	2509	81	20	4921
16	10	24	31	1746	39	35	2535	82	28	4972
16	20	24	47	1764	39	58	2561	83	16	5023
16	30	25	02	1782	40	25	2587	84	09	5075
16	40	25	18	1800	40	50	2613	84	58	5126
16	50	25	34	1818	41	15	2639	85	55	5177
17	0	25	49	1836	41	40	2665	86	44	5228
17	10	26	05	1854	42	05	2691	87	38	5280
17	20	26	21	1872	42	30	2718	88	31	5331
17	30	26	36	1890	42	56	2744	89	25	5382
17	40	26	52	1908	43	21	2770	90	18	5433
17	50	27	08	1926	43	46	2796	91	07	5485

Latitude		1 Rumb, 11° 15′.			2 Rumb, 22° 30′.			3 Rumb, 33° 45′.			4 Rumb, 45° 00′.		
		Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
18	0	3	38	1101	7	34	1169	12	14	1290	18	19	1527
18	10	3	40	1111	7	40	1180	12	21	1318	18	29	1541
18	20	3	42	1122	7	44	1191	12	28	1323	18	39	1556
18	30	3	44	1132	7	48	1201	12	35	1335	18	49	1570
18	40	3	46	1142	7	52	1212	12	42	1347	19	00	1584
18	50	3	49	1152	7	57	1223	12	49	1359	19	10	1598
19	0	3	51	1162	8	01	1234	12	56	1371	19	21	1612
19	10	3	53	1173	8	05	1245	13	03	1383	19	31	1626
19	20	3	55	1183	8	10	1256	13	11	1395	19	42	1640
19	30	3	57	1193	8	14	1266	13	18	1407	19	53	1655
19	40	3	59	1203	8	19	1277	13	25	1419	20	04	1669
19	50	4	01	1213	8	23	1288	13	32	1431	20	14	1683
20	0	4	04	1224	8	28	1299	13	39	1443	20	25	1697
20	10	4	07	1234	8	32	1310	13	46	1455	20	35	1711
20	20	4	09	1244	8	36	1321	13	53	1467	20	46	1725
20	30	4	11	1254	8	41	1331	14	02	1479	20	57	1739
20	40	4	13	1264	8	45	1342	14	08	1491	21	07	1744
20	50	4	15	1274	8	49	1353	14	15	1503	21	18	1758
21	0	4	17	1285	8	54	1364	14	22	1515	21	28	1782
21	10	4	19	1295	8	59	1375	14	29	1527	21	39	1796
21	20	4	21	1305	9	03	1385	14	36	1539	21	50	1811
21	30	4	23	1315	9	07	1396	14	44	1551	22	01	1825
21	40	4	25	1325	9	12	1407	14	51	1563	22	12	1839
21	50	4	27	1336	9	16	1418	14	58	1575	22	22	1854
22	0	4	29	1346	9	20	1429	15	05	1588	22	33	1867
22	10	4	31	1356	9	25	1440	15	12	1600	22	44	1871
22	20	4	33	1366	9	30	1450	15	19	1612	22	55	1885
22	30	4	35	1376	9	34	1461	15	26	1624	23	06	1899
22	40	4	37	1387	9	38	1472	15	33	1636	23	17	1903
22	50	4	40	1397	9	43	1483	15	41	1648	23	28	1917
23	0	4	42	1407	9	48	1494	15	48	1660	23	39	1952
23	10	4	44	1417	9	52	1505	15	55	1672	23	49	1966
23	20	4	46	1427	9	57	1515	16	03	1684	24	00	1980
23	30	4	48	1438	10	02	1526	16	10	1696	24	11	1993
23	40	4	50	1448	10	07	1537	16	17	1708	24	22	2008
23	50	4	52	1458	10	11	1548	16	24	1720	24	33	2022

Latitude.		5 Rumb, 56° 15′.			6 Rumb, 67° 30′.			7 Rumb, 78° 45′.		
		Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.	
18	0	27	24	1944	44	11	2822	92	01	5536
18	10	27	39	1962	44	37	2848	92	55	5587
18	20	27	55	1980	44	02	2874	93	44	5638
18	30	28	11	1998	45	27	2901	94	40	5690
18	40	28	27	2016	45	55	2927	95	32	5741
18	50	28	42	2034	46	18	2953	95	56	5792
19	0	28	58	2052	46	45	2979	97	29	5843
19	10	29	14	2070	47	11	3005	98	14	5895
19	20	29	30	2088	47	36	3031	99	04	5946
19	30	29	46	2106	48	02	3057	99	58	5997
19	40	30	02	2124	48	27	3083	100	52	6048
19	50	30	18	2142	48	53	3110	101	46	6100
20	0	30	34	2160	49	18	3136	102	40	6151
20	10	30	50	2178	49	44	3162	103	30	6202
20	20	31	06	2196	50	09	3188	104	25	6254
20	30	31	21	2214	50	35	3216	105	19	6305
20	40	31	37	2232	51	01	3230	106	14	6356
20	50	31	53	2250	51	26	3266	107	08	6407
21	0	32	09	2268	51	52	3292	108	03	6458
21	10	32	25	2286	52	20	3319	108	53	6510
21	20	32	42	2304	52	43	3345	109	48	6561
21	30	32	57	2322	53	11	3371	110	43	6612
21	40	33	14	2340	53	37	3397	111	38	6664
21	50	33	30	2358	54	03	3423	112	32	6715
22	0	33	46	2376	54	29	3449	113	25	6746
22	10	34	02	2394	54	55	3475	114	20	6797
22	20	34	18	2412	55	21	3502	115	13	6849
22	30	34	35	2430	55	47	3528	116	09	6900
22	40	34	51	2448	56	13	3554	117	04	6951
22	50	35	07	2466	56	39	3580	117	59	7002
23	0	35	23	2484	57	05	3606	118	50	7075
23	10	35	40	2502	57	31	3632	119	45	7126
23	20	35	56	2520	57	57	3658	120	41	7177
23	30	36	12	2538	58	23	3684	121	37	7228
23	40	36	28	2556	58	52	3711	122	32	7280
23	50	36	45	2574	59	18	3736	123	24	7331

Latitude		1 Rumb, 11° 15'.			2 Rumb, 22° 30'.			3 Rumb, 33° 45'.			4 Rumb, 45° 00'.		
		Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
24	0	4	55	1468	10	15	1559	16	31	1732	24	44	2036
24	10	4	57	1478	10	19	1570	16	39	1744	24	55	2041
24	20	4	59	1489	10	24	1580	16	46	1756	25	06	2055
24	30	5	02	1499	10	29	1591	16	53	1768	25	17	2069
24	40	5	04	1509	10	33	1602	17	01	1780	25	28	2083
24	50	5	06	1519	10	37	1613	17	08	1792	25	32	2097
25	0	5	08	1530	10	42	1624	17	16	1804	25	50	2121
25	10	5	10	1540	10	46	1634	17	23	1816	26	01	2135
25	20	5	12	1550	10	51	1645	17	30	1828	26	12	2150
25	30	5	14	1560	10	56	1656	17	38	1840	26	23	2164
25	40	5	16	1570	11	01	1667	17	45	1852	26	34	2178
25	50	5	18	1580	11	05	1678	17	52	1864	26	45	2192
26	0	5	21	1591	11	09	1688	18	00	1876	26	56	2206
26	10	5	23	1601	11	14	1699	18	07	1888	27	07	2220
26	20	5	26	1611	11	19	1710	18	15	1900	27	08	2234
26	30	5	28	1621	11	23	1721	18	22	1912	27	29	2249
26	40	5	30	1631	11	28	1732	18	30	1924	27	40	2263
26	50	5	32	1642	11	32	1743	18	37	1936	27	51	2277
27	0	5	34	1652	11	37	1753	18	45	1948	28	03	2291
27	10	5	36	1662	11	42	1764	18	52	1960	28	14	2305
27	20	5	39	1672	11	47	1775	19	00	1972	28	25	2319
27	30	5	41	1682	11	51	1786	19	07	1984	28	37	2333
27	40	5	43	1693	11	56	1797	19	15	1996	28	49	2348
27	50	5	46	1703	12	01	1808	19	22	2009	28	59	2362
28	0	5	48	1713	12	06	1818	19	30	2021	29	11	2376
28	10	5	50	1723	12	10	1829	19	37	2033	29	22	2390
28	20	5	52	1733	12	15	1840	19	45	2045	29	34	2404
28	30	5	55	1744	12	20	1851	19	56	2057	29	46	2418
28	40	5	57	1754	12	25	1862	20	00	2069	29	57	2432
28	50	6	00	1764	12	30	1872	20	08	2081	30	08	2447
29	0	6	02	1774	12	34	1883	20	16	2093	30	19	2461
29	10	6	04	1784	12	39	1894	20	23	2105	30	31	2475
29	20	6	07	1795	12	43	1905	20	30	2117	30	43	2489
29	30	6	09	1805	12	48	1916	20	38	2129	30	54	2503
29	40	6	11	1815	12	52	1927	20	46	2141	31	05	2517
29	50	6	13	1825	12	57	1937	20	54	2153	31	17	2531

Latitude.		5 Rumb, 56° 15'.			6 Rumb, 67° 30'.			7 Rumb, 78° 45'.		
		Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.	
24	0	37	01	2592	59	44	3763	124	24	7381
24	10	37	17	2610	60	11	3789	125	15	7432
24	20	37	34	2628	60	37	3815	126	11	7484
24	30	37	50	2646	61	03	3841	127	07	7535
24	40	38	07	2664	61	30	3867	128	00	7586
24	50	38	22	2682	61	56	3894	128	57	7537
25	0	38	40	2200	62	22	3920	129	52	7689
25	10	38	56	2718	62	49	3946	130	48	7740
25	20	39	13	2736	63	15	3972	131	44	7791
25	30	39	29	2754	63	42	3998	132	56	7842
25	40	39	46	2772	64	09	4024	133	33	7894
25	50	40	02	2790	64	34	4050	134	29	7945
26	0	40	19	2808	65	02	4076	135	26	7996
26	10	40	36	2826	65	31	4103	136	23	8048
26	20	40	53	2844	65	56	4129	137	20	8098
26	30	41	09	2862	66	25	4155	138	17	8150
26	40	41	26	2880	66	30	4181	139	09	8201
26	50	41	42	2898	67	19	4207	140	07	8253
27	0	42	00	2916	67	45	4233	141	04	8304
27	10	42	17	2934	68	12	4259	142	01	8355
27	20	42	33	2952	68	39	4285	142	56	8406
27	30	42	50	2970	69	06	4312	143	51	8458
27	40	43	07	2988	69	33	4338	144	49	8500
27	50	43	24	2906	70	00	4344	145	46	8560
28	0	43	41	3024	70	27	4390	146	44	8611
28	10	43	58	3042	70	55	4416	147	33	8663
28	20	44	15	3060	71	22	4442	148	35	8714
28	30	44	32	3078	71	49	4468	149	33	8765
28	40	44	49	3096	72	19	4495	150	31	8816
28	50	45	06	3114	72	44	4521	151	29	8868
29	0	45	23	3132	73	14	4547	152	28	8919
29	10	45	40	3150	73	41	4573	153	24	8970
29	20	45	57	3168	74	09	4599	154	23	9021
29	30	46	15	3186	74	37	4625	155	19	9073
29	40	46	22	3204	75	04	4651	156	17	9124
29	50	46	49	3222	75	32	4677	157	16	9175

Latitude		1 Rumb, 11° 15'.			2 Rumb, 22° 30'.			3 Rumb, 33° 45'.			4 Rumb, 45° 00'.		
		Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
30	0	6	16	1835	13	02	1948	21	01	2165	31	27	2546
30	10	6	18	1845	13	07	1059	21	09	2177	31	40	2560
30	20	6	20	1856	13	11	197	21	17	2189	31	51	2574
30	30	6	23	1866	13	16	1981	21	24	2201	32	03	2588
30	40	6	25	1876	13	21	1992	21	32	2213	32	15	2602
30	50	6	27	1886	13	26	2002	21	40	2225	32	29	2616
31	0	6	29	1896	13	30	2013	21	47	2237	32	38	2630
31	10	6	31	1907	13	35	2024	21	55	2249	32	49	2645
31	20	6	34	1917	13	40	2035	22	03	2261	33	00	2659
31	30	6	36	1927	13	45	2046	22	11	2273	33	12	2673
31	40	6	39	1937	13	50	2056	22	19	2285	33	25	2687
31	50	6	41	1947	13	56	2067	22	27	2297	33	37	2701
32	0	6	43	1958	14	01	2078	22	34	2309	33	48	2715
32	10	6	46	1968	14	06	2089	22	42	2321	34	00	2730
32	20	6	48	1978	14	10	2100	22	50	2333	34	12	2744
32	30	6	50	1988	14	15	2111	22	58	2345	34	24	2758
32	40	6	52	1998	14	20	2121	23	06	2357	34	36	2772
32	50	6	55	2009	14	25	2132	23	14	2369	34	48	2786
33	0	6	57	2019	14	30	2143	23	21	2381	35	00	2800
33	10	7	00	2029	14	35	2154	23	30	2393	35	12	2814
33	20	7	03	2039	14	40	2165	23	38	2405	35	23	2828
33	30	7	05	2049	14	45	2176	23	46	2417	35	35	2843
33	40	7	08	2060	14	49	2186	23	54	2429	35	47	2857
33	50	7	10	2070	14	54	2197	24	02	2441	35	59	2871
34	0	7	13	2080	14	59	2208	24	10	2454	36	11	2885
34	10	7	15	2090	15	04	2219	24	18	2466	36	23	2890
34	20	7	18	2100	15	09	2230	24	26	2478	36	35	2903
34	30	7	20	2111	15	14	2240	24	34	2490	36	47	2917
34	40	7	22	2121	15	20	2251	24	42	2502	36	56	2932
34	50	7	24	2131	15	25	2262	24	50	2514	37	12	2946
35	0	7	26	2141	15	29	2273	24	59	2526	37	24	2970
35	10	7	29	2151	15	34	2284	25	07	2538	37	36	2984
35	20	7	31	2162	15	39	2295	25	15	2550	37	48	3008
35	30	7	34	2172	15	44	2305	25	23	2562	38	00	30[illegible]
35	40	7	36	2182	15	50	2316	25	31	2574	38	13	3[illegible]
35	50	7	3[illegible]	2192	15	55	2327	25	40	2586	38	25	3[illegible]

Latitude.		5 Rumb, 56° 15'.			6 Rumb, 67° 30'.			7 Rumb, 78° 45'.		
		Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.	
30	0	47	06	3240	76	00	4704	158	15	9226
30	10	47	24	3258	76	27	4730	159	14	9278
30	20	47	41	3276	76	55	4756	160	08	9329
30	30	47	58	3294	77	23	4782	161	08	9380
30	40	48	16	3312	77	51	4808	162	07	9431
30	50	48	33	3330	78	19	4834	163	06	9483
31	0	48	50	3348	78	47	4860	164	03	9534
31	10	49	08	3366	79	17	4886	165	03	9585
31	20	49	25	3384	79	43	4913	166	01	9636
31	30	49	43	3402	80	13	4939	167	00	9688
31	40	50	01	3420	80	41	4965	168	00	9739
31	50	50	18	3438	81	10	4991	169	00	9790
32	0	50	36	3456	81	38	5017	170	00	9842
32	10	50	53	3474	82	06	5043	170	55	9893
32	20	51	11	3492	82	35	5069	171	55	9944
32	30	51	29	3510	83	31	5095	172	56	9995
32	40	51	47	3528	83	32	5122	173	56	10047
32	50	52	04	3546	84	01	5148	174	53	10098
33	0	52	22	3564	84	29	5174	175	54	10149
33	10	52	40	3582	84	58	5200	176	55	10200
33	20	52	58	3600	85	26	5226	177	56	10252
33	30	53	16	3618	85	55	5252	178	57	10303
33	40	53	34	3636	86	26	5278	179	58	10354
33	50	53	50	3654	86	52	5305	180	57	10405
34	0	54	10	3672	87	24	5331	181	56	10457
34	10	54	28	3690	87	52	5357	182	57	10508
34	20	54	46	3708	88	02	5383	183	59	10559
34	30	55	04	3726	88	50	5409	184	59	10610
34	40	55	22	3744	89	20	5435	185	58	10662
34	50	55	41	3762	89	49	5461	187	00	10713
35	0	55	59	3780	90	19	5488	188	02	10764
35	10	56	17	3798	90	48	5514	189	05	10815
35	20	56	35	3816	91	18	5540	190	04	10867
35	30	56	54	3834	91	48	5566	191	06	10918
35	40	57	12	3852	92	17	5592	192	09	10969
35	50	57	30	3870	92	46	5618	193	11	11020

Latitude		1 Rumb, 11° 15′.			2 Rumb, 22° 30′.			3 Rumb, 33° 45′.			4 Rumb, 45° 00′.		
		Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
36	0	7	41	2202	16	00	2338	25	49	2598	38	38	3055
36	10	7	43	2212	16	05	2349	25	57	2610	38	50	3069
36	20	7	46	2223	16	11	2360	26	05	2622	39	03	3083
36	30	7	48	2233	16	16	2370	26	13	2634	39	15	3097
36	40	7	50	2243	16	21	2381	26	22	2646	39	27	3111
36	50	7	53	2253	16	26	2392	26	30	2658	39	40	3125
37	0	7	56	2263	16	32	2403	26	38	2670	39	53	3140
37	10	7	59	2274	16	37	2414	26	47	2681	40	05	3154
37	20	8	02	2284	16	42	2425	26	55	2693	40	18	3168
37	30	8	04	2294	16	47	2435	27	03	2705	40	31	3182
37	40	8	06	2304	16	52	2446	27	12	2717	40	43	3196
37	50	8	09	2314	16	57	2457	27	20	2729	40	56	3210
38	0	8	11	2325	17	02	2468	27	28	2742	41	08	3224
38	10	8	13	2335	17	08	2479	27	37	2754	41	21	3239
38	20	8	16	2345	17	13	2490	27	45	2766	41	33	3259
38	30	8	19	2355	17	18	2500	27	54	2778	41	46	3262
38	40	8	21	2366	17	23	2511	28	03	2790	42	00	3281
38	50	8	24	2376	17	28	2522	28	11	2802	42	13	3296
39	0	8	26	2386	17	32	2533	28	20	2814	42	26	3309
39	10	8	28	2396	17	19	2544	28	29	2826	42	39	3323
39	20	8	31	2406	17	44	2554	28	37	2838	42	52	3338
39	30	8	34	2417	17	49	2565	28	46	2850	43	04	3352
39	40	8	37	2427	17	55	2576	28	55	2862	43	17	3366
39	50	8	39	2437	18	00	2587	29	04	2874	43	30	3380
40	0	8	42	2447	18	06	2598	29	12	2886	43	43	3394
40	10	8	44	2457	18	12	2609	29	21	2898	43	56	3408
40	20	8	47	2467	18	20	2619	29	30	2911	44	09	3422
40	30	8	49	2478	18	22	2630	29	38	2923	44	21	3437
40	40	8	52	2488	18	28	2641	29	47	2935	44	34	3451
40	50	8	55	2408	18	34	2652	29	56	2947	44	48	3465
41	0	8	57	2508	18	40	2663	30	05	2959	45	02	3479
41	10	9	00	2519	18	45	2674	30	14	2971	45	16	3493
41	20	9	03	2529	18	50	2684	30	23	2983	45	29	3507
41	30	9	06	2539	18	56	2695	30	32	2995	45	42	3521
41	40	9	08	2549	19	01	2706	30	40	3006	45	55	3535
41	50	9	12	2560	19	06	2717	30	50	3019	46	08	3550

Latitude.		5 Rumb, 56° 15′.			6 Rumb, 67° 30′.			7 Rumb, 78° 45′.		
		Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.	
36	0	57	49	3888	93	16	5644	194	14	11072
36	10	58	08	3906	93	48	5670	195	17	11123
36	20	58	26	3924	94	16	5697	196	18	11174
36	30	58	45	3942	94	48	5723	197	20	11226
36	40	59	03	3960	95	18	5741	198	22	11277
36	50	59	22	3978	95	48	5775	199	26	11328
37	0	59	41	3996	96	18	5801	200	29	11379
37	10	60	00	4014	96	48	5827	201	31	11421
37	20	60	18	4032	97	18	5853	202	33	11472
37	30	60	37	4050	97	48	5879	203	37	11423
37	40	60	56	4068	98	19	5906	204	41	11574
37	50	61	15	4086	98	49	5932	205	46	11626
38	0	61	34	4104	99	19	5958	206	50	11687
38	10	61	52	4122	99	49	5984	207	54	11738
38	20	62	12	4140	100	20	6010	208	55	11789
38	30	62	31	4158	100	51	6036	210	06	11841
38	40	62	50	4176	101	24	6062	211	05	11892
38	50	63	09	4194	101	52	6089	212	10	11943
39	0	63	29	4212	102	26	6115	213	15	11994
39	10	63	48	4230	102	56	6141	214	20	12046
39	20	64	07	4248	103	28	6167	215	24	12097
39	30	64	27	4266	103	58	6193	216	29	12148
39	40	64	46	4284	104	30	6219	217	35	12199
39	50	65	06	4302	105	02	6245	218	41	12251
40	0	65	25	4320	105	32	6271	219	42	12302
40	10	65	45	4338	106	04	6298	220	49	12353
40	20	66	04	4356	106	35	6324	221	56	12404
40	30	66	24	4374	107	06	6350	223	03	12456
40	40	66	44	4392	107	39	6378	224	10	12507
40	50	67	04	4410	108	10	6402	225	18	12558
41	0	67	23	4428	108	42	6428	226	23	12609
41	10	67	43	4436	109	16	6454	227	27	12661
41	20	68	03	4454	109	46	6480	228	35	12712
41	30	68	23	4472	110	20	6507	229	43	12763
41	40	68	43	4490	110	52	6533	230	46	12815
41	50	69	03	4418	111	25	6559	231	53	12866

Latitude		1 Rumb, 11° 15'.			2 Rumb, 22° 30'.			3 Rumb, 33° 45'.			4 Rumb, 45 00'.		
		Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
42	0	9	13	2569	19	12	2728	31	00	3031	46	22	3564
42	10	9	16	2580	19	18	2739	31	08	3043	46	36	3578
42	20	9	18	2591	19	23	2749	31	17	3055	46	49	3592
42	30	9	21	2600	19	29	2760	31	26	3067	47	02	3606
42	40	9	24	2610	19	35	2771	31	35	3079	47	16	3620
42	50	9	27	2620	19	40	2882	31	44	3091	47	30	3634
43	0	9	30	2631	19	46	2793	31	53	3103	47	43	3649
43	10	9	32	2641	19	51	2803	32	02	3115	47	56	3663
43	20	9	35	2651	19	57	2814	32	11	3127	48	10	3677
43	30	9	37	2661	20	03	2825	32	20	3139	48	25	3601
43	40	9	40	2671	20	06	2836	32	29	3151	48	39	3715
43	50	9	43	2682	20	13	2847	32	38	3163	48	53	3729
44	0	9	46	2692	20	19	2858	32	47	3175	49	06	3733
44	10	9	48	2702	20	26	2868	32	57	3187	49	20	3748
44	20	9	51	2712	20	32	2879	33	07	3199	49	34	3762
44	30	9	54	2722	20	38	2890	33	16	3211	49	48	3776
44	40	9	57	2733	20	44	2901	33	25	3223	50	02	3790
44	50	10	00	2743	20	50	2912	33	34	3235	50	16	3804
45	0	10	03	2753	20	56	2923	33	48	3247	50	30	3818
45	10	10	06	2763	21	01	2933	33	53	3259	50	43	3832
45	20	10	08	2773	21	07	2944	34	02	3271	50	57	3847
45	30	10	11	2784	21	16	2955	34	12	3283	51	12	3861
45	40	10	14	2794	21	19	2966	34	23	3295	51	26	3875
45	50	10	17	2804	21	25	2977	34	33	3307	51	40	3889
46	0	10	19	2814	21	31	2988	34	42	3319	51	54	3903
46	10	10	22	2824	21	33	2998	34	52	3331	52	10	3917
46	20	10	25	2835	21	42	3009	35	01	3343	52	25	3931
46	30	10	28	2845	21	48	3020	35	11	3356	52	39	3946
46	40	10	31	2855	21	54	3031	35	21	3368	52	54	3960
46	50	10	34	2865	22	00	3041	35	30	3380	53	28	3974
47	0	10	37	2875	22	06	3052	35	40	3392	53	23	3988
47	10	10	40	2886	22	12	3063	35	50	3404	53	37	4002
47	20	10	43	2896	22	18	3074	36	00	3416	53	52	4016
47	30	10	45	2906	22	24	3085	36	10	3428	54	06	4030
47	40	10	48	2916	22	30	3096	36	20	3440	54	21	4045
47	50	10	51	2926	22	36	3106	36	30	3452	54	36	4059

Latitude.		5 Rumb, 56° 15'.			6 Rumb, 67 30'.			7 Rumb, 78° 45'.		
		Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.	
42	0	69	23	4536	111	56	6585	233	03	12917
42	10	69	43	4554	112	29	6611	234	12	12968
42	20	70	04	4572	113	01	6637	235	21	13020
42	30	70	24	4590	113	34	6663	236	30	13061
42	40	70	44	4608	114	06	6690	237	34	13112
42	50	71	04	4626	114	39	6716	238	43	13163
43	0	71	25	4644	115	12	6742	239	53	13215
43	10	71	45	4662	115	45	6768	241	02	13266
43	20	72	06	4680	116	19	6794	242	12	13317
43	30	72	27	4698	116	51	6820	243	20	13368
43	40	72	47	4716	117	27	6846	244	34	13420
43	50	73	08	4734	117	58	6872	245	39	13471
44	0	73	29	4752	118	34	6899	246	50	13532
44	10	73	50	4770	119	06	6925	248	01	13583
44	20	74	11	4788	119	40	6951	249	12	13635
44	30	74	31	4806	120	13	6977	250	23	13686
44	40	74	52	4824	120	48	7003	251	29	13737
44	50	75	12	4842	121	21	7029	252	41	13788
45	0	75	35	4860	121	56	7055	253	34	13840
45	10	75	56	4878	122	30	7082	255	04	13891
45	20	76	17	4896	123	04	7108	256	11	13942
45	30	76	38	4914	123	38	7134	257	24	13993
45	40	77	00	4932	124	13	7160	258	38	14045
45	50	77	21	4950	124	47	7186	259	50	14096
46	0	77	43	4968	125	22	7212	261	04	14147
46	10	78	04	4986	125	56	7238	262	12	14198
46	20	78	26	5004	126	31	7264	263	28	14250
46	30	78	47	5022	127	08	7291	264	39	14301
46	40	79	09	5040	127	43	7317	265	53	14352
46	50	79	30	5058	128	18	7343	267	08	14403
47	0	79	53	5076	128	53	7369	268	23	14455
47	10	80	15	5094	129	28	7395	269	23	14506
47	20	80	37	5112	130	04	7321	270	47	14557
47	30	80	59	5130	130	40	7347	272	02	14609
47	40	81	22	5148	131	13	7373	273	18	14660
47	50	81	43	5166	131	52	7400	274	34	14711

Latitude		1 Rumb, 11° 15′. Longitude		1 Rumb Dist. in Miles.	2 Rumb, 22° 30′. Longitude		2 Rumb Dist. in Miles.	3 Rumb, 33° 45′. Longitude		3 Rumb Dist. in Miles.	4 Rumb, 45° 00′. Longitude		4 Rumb Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
48	0	10	54	2936	22	41	3117	36	40	3464	54	52	4073
48	10	10	57	2947	22	49	3128	36	50	3476	55	05	4087
48	20	11	00	2957	22	56	3139	37	00	3488	55	22	4101
48	30	11	04	2967	23	03	3150	37	10	3500	55	37	4115
48	40	11	07	2977	23	10	3161	37	20	3512	55	51	4129
48	50	11	10	2987	23	16	3171	37	30	3524	56	07	4144
49	0	11	13	2998	23	22	3182	37	40	3536	56	22	4158
49	10	11	16	3008	23	27	3193	37	50	3548	56	38	4172
49	20	11	19	3018	23	33	3204	38	00	3560	56	52	4186
49	30	11	22	3028	23	40	3215	38	10	3572	57	08	4200
49	40	11	25	3038	23	46	3225	38	20	3584	57	23	4214
49	50	11	28	3049	23	52	3236	38	30	3596	57	39	4228
50	0	11	31	3059	23	59	3247	38	42	3608	57	54	4243
50	10	11	34	3069	24	05	3258	38	52	3620	58	10	4255
50	20	11	37	3079	24	12	3269	39	03	3632	58	26	4271
50	30	11	40	3089	24	19	3280	39	13	3644	58	42	4285
50	40	11	44	3100	24	26	3290	39	24	3656	58	58	4299
50	50	11	47	3110	24	32	3301	39	34	3668	59	14	4313
51	0	11	50	3120	24	38	3312	39	45	3680	59	30	4327
51	10	11	53	3130	24	45	3323	39	55	3692	59	46	4342
51	20	11	56	3140	24	52	3334	40	06	3704	60	01	4356
51	30	12	00	3150	24	58	3345	40	16	3716	60	17	4370
51	40	12	03	3161	25	05	3355	40	27	3728	60	33	4384
51	50	12	06	3171	25	12	3366	40	38	3741	60	49	4398
52	0	12	09	3181	25	18	3377	40	49	3753	61	05	4412
52	10	12	12	3191	25	25	3388	41	00	3765	61	21	4426
52	20	12	15	3202	25	32	3399	41	10	3777	61	37	4441
52	30	12	19	3212	25	39	3410	41	22	3789	61	54	4455
52	40	12	22	3222	25	45	3420	41	32	3801	62	10	4469
52	50	12	26	3232	25	52	3431	41	43	3813	62	26	4483
53	0	12	29	3242	25	56	3442	41	55	3825	62	43	4497
53	10	12	32	3253	26	09	3453	42	06	3837	63	00	4511
53	20	12	36	3263	26	13	3464	42	17	3849	63	17	4525
53	30	12	39	3273	26	20	3474	42	28	3861	63	34	4540
53	40	12	42	3283	26	27	3485	42	40	3873	63	51	4554
53	50	12	45	3293	26	34	3496	42	51	3885	64	08	4568

Latitude.		5 Rumb, 56° 15′. Longitude.		5 Rumb Dist. in Miles.	6 Rumb, 67° 30′. Longitude.		6 Rumb Dist. in Miles.	7 Rumb, 78° 45′. Longitude.		7 Rumb Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.	
48	0	82	06	5184	132	28	7426	275	50	14762
48	10	82	28	5202	133	03	7452	277	00	14814
48	20	82	51	5220	133	38	7478	278	17	14865
48	30	83	14	5238	134	16	7504	279	34	14916
48	40	83	36	5256	134	54	7530	280	51	14967
48	50	83	58	5274	135	28	7556	282	08	15019
49	0	84	22	5292	136	07	7683	283	23	15070
49	10	84	44	5310	136	42	7709	284	38	15121
49	20	85	07	5328	137	20	7735	285	56	15172
49	30	85	30	5346	137	57	7761	287	24	15224
49	40	85	54	5364	138	34	7787	288	33	15275
49	50	86	16	5382	139	12	7813	289	46	15326
50	0	86	44	5400	139	49	7839	291	05	15377
50	10	87	03	5418	140	26	7865	292	24	15429
50	20	87	27	5436	141	04	7892	295	44	15480
50	30	87	50	5454	141	41	7918	296	04	15531
50	40	88	14	5472	142	20	7944	296	24	15582
50	50	88	39	5480	142	58	7970	297	45	15634
51	0	89	01	5508	143	36	7996	299	00	15685
51	10	89	25	5526	144	17	8022	300	21	15736
51	20	89	49	5544	144	52	8048	301	43	15787
51	30	90	13	5562	145	34	8074	303	04	15839
51	40	90	37	5580	146	12	8101	304	20	15890
51	50	91	00	5598	146	51	8127	305	42	15941
52	0	91	25	5616	147	30	8153	307	05	15992
52	10	91	50	5634	148	09	8179	308	28	16044
52	20	92	14	5652	148	48	8205	309	52	16095
52	30	92	39	5670	149	28	8231	311	12	16146
52	40	93	03	5688	150	07	8257	312	36	16198
52	50	93	28	5706	150	47	8284	313	57	16249
53	0	93	53	5724	151	27	8310	315	22	16300
53	10	94	18	5742	152	07	8336	316	46	16351
53	20	94	43	5760	152	47	8362	318	12	16403
53	30	95	03	5778	153	27	8388	319	35	16454
53	40	95	33	5796	154	11	8414	320	56	16505
53	50	95	58	5814	154	48	8440	322	23	16556

Latitude		*1 Rumb, 11° 15'.*			*2 Rumb, 22° 30'.*			*3 Rumb, 33° 45'.*			*4 Rumb, 45° 00'.*		
		Longitude		*Dist. in Miles.*	*Longitude*		*Dist. in Miles.*	*Longitude*		*Dist. in Miles.*	*Longitude*		*Dist. in Miles.*
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
54	0	12	49	3303	26	41	3507	43	03	3897	64	24	4582
54	10	12	52	3314	26	48	3518	43	14	3909	64	41	4596
54	20	12	56	3324	26	58	3525	43	25	3921	64	58	4610
54	30	12	59	3334	27	02	3539	43	37	3933	65	15	4624
54	40	13	02	3344	27	09	3550	43	48	3945	65	32	4639
54	50	13	05	3355	27	16	3561	44	00	3957	65	50	4653
55	0	13	09	3365	27	28	3572	44	12	3969	66	08	4667
55	10	13	12	3375	27	31	3583	44	23	3981	66	26	4681
55	20	13	16	3385	27	38	3594	44	35	3993	66	42	4695
55	30	13	20	3395	27	45	3604	44	46	4005	67	01	4709
55	40	13	23	3405	27	53	3615	44	58	4017	67	19	4723
55	50	13	26	3416	28	00	3626	45	10	4029	67	36	4738
56	0	13	30	3426	28	07	3637	45	22	4041	67	54	4752
56	10	13	33	3436	28	15	3648	45	33	4053	68	11	4766
56	20	13	37	3446	28	22	3658	45	45	4065	68	29	4780
56	30	13	41	3456	28	30	3669	45	58	4077	68	47	4794
56	40	13	44	3467	28	37	3680	46	10	4089	69	05	4808
56	50	13	48	3477	28	45	3691	46	22	4101	69	24	4822
57	0	13	52	3487	28	52	3702	46	35	4113	69	42	4837
57	10	13	56	3497	29	00	3713	46	47	4125	70	00	4851
57	20	14	00	3507	29	08	3723	46	59	4137	70	20	4865
57	30	14	03	3518	29	15	3734	47	11	4150	70	38	4879
57	40	14	07	3528	29	23	3745	47	24	4162	70	58	4893
57	50	14	11	3530	29	31	3756	47	37	4174	71	14	4907
58	0	14	15	3548	29	39	3767	47	50	4186	71	34	4921
58	10	14	18	3558	29	46	3778	48	02	4198	71	53	4936
58	20	14	22	3569	29	54	3788	48	15	4210	72	12	4950
58	30	14	26	3579	30	02	3799	48	27	4222	72	31	4963
58	40	14	30	3589	30	10	3810	48	40	4234	72	50	4978
58	50	14	34	3599	30	19	3821	48	53	4246	73	09	4992
59	0	14	37	3609	30	27	3832	49	06	4258	73	28	5006
59	10	14	41	3620	30	35	3843	49	19	4270	73	48	5020
59	20	14	44	3630	30	43	3853	49	32	4282	74	08	5035
59	30	14	48	3640	30	51	3864	49	45	4294	74	26	5049
59	40	14	52	3650	30	59	3875	49	59	4306	74	46	5062
59	50	14	56	3660	31	08	3886	50	01	4318	75	07	5077

Latitude.		*5 Rumb, 56° 15'.*			*6 Rumb, 67° 30'.*			*7 Rumb, 78° 45'.*		
		Longitude.		*Dist. in Miles.*	*Longitude.*		*Dist. in Miles.*	*Longitude.*		*Dist. in Miles.*
D.	M.	D.	M.		D.	M.		D.	M.	
54	0	95	24	5832	155	32	7467	323	49	16608
54	10	96	50	5850	156	13	8493	325	16	16659
54	20	97	15	5868	156	54	8519	326	40	16710
54	30	97	40	5886	157	36	8545	328	04	16761
54	40	98	07	5904	158	17	8571	329	33	16813
54	50	98	32	5922	158	58	8597	331	01	16864
55	0	98	59	5940	159	40	8623	332	30	16915
55	10	99	24	5958	160	22	8649	334	00	16966
55	20	99	51	5976	161	05	8675	335	21	17018
55	30	100	17	5994	161	47	8702	336	51	17069
55	40	100	46	6012	162	29	8728	338	21	17120
55	50	101	10	6030	163	12	8754	339	52	17171
56	0	101	37	6048	163	55	8780	341	23	17223
56	10	102	04	6066	164	40	8806	342	47	17274
56	20	102	31	6084	165	21	8832	344	19	17325
56	30	102	58	6102	166	08	8858	345	51	17376
56	40	103	25	6120	166	52	8885	347	24	17428
56	50	103	52	6138	167	36	8911	348	57	17479
57	0	104	20	6156	168	20	8937	350	27	17530
57	10	104	46	6174	169	04	8963	352	00	17581
57	20	105	15	6192	169	48	8989	353	31	17633
57	30	105	43	6210	170	33	9015	355	06	17684
57	40	106	11	6228	171	18	9041	356	41	17735
57	50	106	39	6246	172	02	9067	358	16	17787
58	0	107	07	6264	172	47	9094	359	45	17838
58	10	107	35	6282	173	32	9120	361	21	17889
58	20	108	04	6300	174	18	9146	362	59	17940
58	30	108	32	6318	175	04	9172	364	36	17992
58	40	109	01	6336	175	54	9198	366	14	18043
58	50	109	30	6354	176	37	9224	367	52	18094
59	0	109	59	6372	177	27	9250	369	29	18145
59	10	110	28	6390	178	13	9277	371	23	18197
59	20	110	57	6408	179	00	9303	372	43	18248
59	30	111	27	6426	179	47	9329	374	23	18299
59	40	111	56	6444	180	35	9355	375	58	18350
59	50	112	26	6462	181	22	9381	377	37	18402

Latitude		1 Rumb, 11° 15′.			2 Rumb, 22° 30′.			3 Rumb, 33° 45′.			4 Rumb, 45° 00′.		
		Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
60	0	15	00	3671	31	16	3897	50	25	4330	75	26	5091
60	10	15	04	3691	31	24	3907	50	38	4342	75	47	5105
60	20	15	08	3701	31	32	391[illegible]	50	52	4354	76	08	5119
60	30	15	12	3711	31	41	3929	51	06	4366	76	28	5134
60	40	15	16	3721	31	48	3940	51	20	4378	76	48	5148
60	50	15	20	3722	31	57	3951	51	33	4390	77	08	5162
61	0	15	25	3732	32	06	3962	51	46	4402	77	29	5176
61	10	15	29	3742	32	15	3972	52	00	4414	77	49	5190
61	20	15	33	3752	32	23	3983	52	14	4426	78	10	5204
61	30	15	37	3762	32	31	3994	52	28	4438	78	31	5218
61	40	15	41	3773	32	40	4005	52	42	4450	78	51	5233
61	50	15	45	3783	32	49	4016	52	56	4462	79	12	5247
62	0	15	49	3793	32	58	4027	53	10	4474	79	34	5260
62	10	15	54	3803	33	07	4037	53	24	4486	79	55	5275
62	20	15	58	3813	33	16	4048	53	38	4498	80	17	5289
62	30	16	03	3824	33	25	4059	53	53	4510	80	38	5303
62	40	16	07	3834	33	34	4070	54	27	4532	81	00	5317
62	50	16	12	3844	33	43	4080	54	21	4554	81	22	5332
63	0	16	16	3854	33	52	4091	54	38	4546	81	44	5346
63	10	16	20	3864	34	01	4102	54	52	4558	82	06	5360
63	20	16	24	3875	34	10	4113	55	06	4570	82	28	5374
63	30	16	29	3895	34	19	4124	55	22	4582	82	51	5388
63	40	16	34	3905	34	28	4135	55	37	4594	83	14	5402
63	50	16	38	3910	34	38	4145	55	52	4616	83	36	5416
64	0	16	43	3915	34	48	4156	56	07	4618	83	59	5431
64	10	16	47	3925	34	58	4167	56	22	4630	84	22	5445
64	20	16	52	3936	35	00	4178	56	38	4642	84	45	5459
64	30	16	56	3946	35	16	4189	56	53	4654	85	09	5473
64	40	17	01	3956	35	26	4200	57	08	4666	85	31	5487
64	50	17	05	3966	35	36	4210	57	24	4679	85	55	5501
65	0	17	10	3976	35	46	4221	57	40	4690	86	19	5515
65	10	17	15	3987	35	55	4232	57	56	4701	86	42	5530
65	20	17	20	3997	36	05	4243	58	12	4715	87	06	5544
65	30	17	25	4007	36	15	4254	58	28	4727	87	29	5558
65	40	17	20	4017	36	25	4267	58	44	4739	87	55	5572
65	50	17	34	4027	36	36	4275	59	01	4750	88	20	5586

Latitude.		5 Rumb, 56° 15′.			6 Rumb, 67° 30′.			7 Rumb, 78° 45′.		
		Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.	
60	0	112	56	6480	182	11	9407	379	19	18453
60	10	113	25	6498	182	59	9433	381	01	18504
60	20	113	56	6506	183	48	9459	382	44	18555
60	30	114	26	6524	184	36	9486	384	27	18607
60	40	114	57	6542	185	26	9512	386	10	18658
60	50	115	27	6560	186	13	9538	387	50	18709
61	0	115	58	6588	187	04	9564	389	32	18760
61	10	116	29	6606	187	57	9590	391	18	18812
61	20	116	59	6624	188	43	9616	393	04	18863
61	30	117	31	6642	188	38	9642	394	50	18914
61	40	118	03	6660	190	28	9668	396	29	18965
61	50	118	34	6678	191	19	9695	398	17	19017
62	0	119	06	6696	192	10	9721	400	05	19068
62	10	119	37	6714	193	01	9747	401	54	19119
62	20	120	10	6732	193	52	9773	403	43	19170
62	30	120	43	6750	194	44	9799	405	28	19222
62	40	121	15	6768	195	37	9825	407	16	19273
62	50	121	44	6786	196	30	9851	409	08	19324
63	0	122	21	6804	197	23	9878	411	00	19376
63	10	122	53	6822	198	16	9904	412	52	19427
63	20	123	27	6840	199	09	9930	414	36	19478
63	30	124	00	6858	200	03	9956	416	31	19529
63	40	124	34	6876	201	00	9982	418	25	19581
63	50	125	08	6894	201	51	10008	420	20	19632
64	0	125	42	6912	202	49	10034	422	16	19683
64	10	126	16	6930	203	43	10060	424	08	19734
64	20	126	51	6948	204	38	10087	426	01	19787
64	30	127	26	6966	205	34	10113	428	00	19837
64	40	128	00	6984	206	31	10139	430	00	19888
64	50	128	35	7002	207	27	10165	431	58	19939
65	0	129	11	7020	208	24	10191	433	58	19991
65	10	129	46	7038	209	20	10217	435	50	20041
65	20	130	22	7056	210	18	10243	437	52	20093
65	30	130	58	7074	211	16	10269	439	54	20144
65	40	131	34	7092	212	15	10296	441	57	20195
65	50	132	10	7110	213	12	10322	444	02	20247

Latitude		1 Rumb, 11° 15′.			2 Rumb, 22° 30′.			3 Rumb, 33° 45′.			4 Rumb, 45° 00′.		
		Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.	Longitude		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.		D.	M.	
66	0	17	39	4038	36	46	4283	59	17	4763	88	44	5600
66	10	17	43	4048	36	56	4297	59	33	4775	89	08	5614
66	20	17	48	4058	37	05	4308	59	50	4787	89	32	5629
66	30	17	53	4068	37	16	4319	60	06	4799	89	57	5643
66	40	17	58	4078	37	26	4330	60	23	4811	90	23	5657
66	50	18	03	4089	37	38	4340	60	40	4823	90	48	5671
67	0	18	08	4099	37	48	4351	60	58	4835	91	13	5685
67	10	18	13	4109	37	58	4362	61	15	4847	91	38	5699
67	20	18	18	4119	38	09	4373	61	32	4859	92	04	5713
67	30	18	24	4129	38	20	4384	61	49	4861	92	30	5728
67	40	18	30	4140	38	30	4394	62	07	4883	92	56	5732
67	50	18	33	4150	38	40	4405	62	24	4895	93	23	5740
68	0	18	40	4160	38	52	4416	62	41	4907	93	50	5770
68	10	18	45	4170	39	04	4427	62	59	4919	94	17	5784
68	20	18	51	4180	39	15	4438	63	17	4931	94	44	5798
68	30	18	56	4190	39	26	4448	63	35	4943	95	11	5812
68	40	19	02	4201	39	38	4459	63	54	4955	95	38	5826
68	50	19	07	4211	39	59	4470	64	12	4967	96	05	5841
69	0	19	12	4221	40	00	4481	64	31	4989	96	33	5855
69	10	19	17	4231	40	12	4492	64	50	5001	97	02	5869
69	20	19	24	4241	40	24	4503	65	08	5013	97	30	5883
69	30	19	29	4252	40	35	4514	65	27	5025	98	00	5897
69	40	19	35	4262	40	45	4524	65	46	5037	98	29	5911
69	50	19	40	4272	40	58	4535	66	05	5049	98	58	5925
70	0	19	45	4282	41	10	4546	66	25	5051	99	26	5940
70	10	19	50	4292	42	26	4557	68	27	5063	99	54	5954
70	20	19	55	4302	43	45	4568	70	33	5075	100	24	5968
70	30	20	00	4312	45	07	4578	72	47	5087	100	54	5982
70	40	20	05	4322	46	31	4589	75	07	5099	101	24	5996
70	50	20	10	4332			4600			5111	101	54	6010

Latitude.		5 Rumb, 56° 15′.			6 Rumb, 67° 30′.			7 Rumb, 78° 45′.		
		Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.	Longitude.		Dist. in Miles.
D.	M.	D.	M.		D.	M.		D.	M.	
66	0	132	47	7128	214	11	10348	445	58	20298
66	10	133	24	7146	215	10	10374	448	03	20349
66	20	134	01	7164	216	13	10400	450	10	20400
66	30	134	38	7182	217	15	10426	452	18	20451
66	40	135	16	7200	218	17	10452	454	26	20503
66	50	135	54	7218	219	18	10479	456	28	20554
67	0	136	32	7236	229	19	10567	458	40	20605
67	10	137	09	7254	221	20	10531	460	46	20656
67	20	137	49	7272	222	21	10557	462	58	20708
67	30	138	28	7290	223	23	10583	465	11	20759
67	40	139	08	7308	224	26	10609	467	24	20810
67	50	139	47	7326	225	29	10635	469	28	20862
68	0	140	27	7344	226	33	10661	471	44	20913
68	10	141	07	7362	227	36	10688	474	01	20964
68	20	141	47	7380	228	41	10714	476	18	21015
68	30	142	29	7398	229	45	10740	478	37	21067
68	40	143	09	7416	230	49	10766	480	57	21118
68	50	143	49	7434	232	41	10792	483	12	21169
69	0	144	32	7452	233	13	10818	485	28	21220
69	10	145	14	7470	234	21	10844	487	51	21272
69	20	145	56	7488	235	29	10870	490	15	21323
69	30	146	39	7506	236	37	10897	492	40	21374
69	40	147	22	7524	237	46	10923	494	59	21425
69	50	148	06	7542	238	54	10949	497	24	21477
70	0	148	48	7560	240	04	10975	499	51	21528
70	10	149	33	7578	241	13	11001	502	21	21579
70	20	150	17	7596	242	23	11027	504	52	21630
70	30	151	01	7614	242	34	11053	507	20	21682
70	40	151	47	7632	244	48	11080	509	47	21733
70	50	152	31	7650	244	00	11106	512	21	21784

A Table of LOGARITHMS

For Numbers increasing orderly from 1 to 10000, with their Differences:

Whereby the Logarithm of any Number under 1000000 *may be readily taken.*

Nu.	Log.	Nu.	Log.	Nu.	Log.	Nu.	Log.
1	0.0000000	26	1.4149733	51	1.7075702	76	1.8808136
2	0.3010300	27	1.4313637	52	1.7160033	77	1.8864907
3	0.4771212	28	1.4471580	53	1.7242759	78	1.8920946
4	0.6020600	29	1.4623980	54	1.7323937	79	1.8976271
5	0.6989700	30	1.4771212	55	1.7403627	80	1.9030900
6	0.7781512	31	1.4913617	56	1.7481880	81	1.9084850
7	0.8450980	32	1.5051500	57	1.7558748	82	1.9138138
8	0.9030900	33	1.5185139	58	1.7634280	83	1.9190781
9	0.9542425	34	1.5314789	59	1.7708520	84	1.9242793
10	1.0000000	35	1.5440680	60	1.7781512	85	1.9294189
11	1.0413927	36	1.5563025	61	1.7853298	86	1.9344984
12	1.0791812	37	1.5682017	62	1.7923917	87	1.9395192
13	1.1139433	38	1.5797836	63	1.7993405	88	1.9444827
14	1.1461280	39	1.5910646	64	1.8061800	89	1.9493900
15	1.1760912	40	1.6020600	65	1.8129133	90	1.9542425
16	1.2041200	41	1.6127838	66	1.8195439	91	1.9590414
17	1.2304489	42	1.6232493	67	1.8260748	92	1.9637878
18	1.2552725	43	1.6334684	68	1.8325089	93	1.9684829
19	1.2787536	44	1.6434527	69	1.8388491	94	1.9731278
20	1.3010300	45	1.6532125	70	1.8450980	95	1.9777236
21	1.3222193	46	1.6627578	71	1.8512583	96	1.9822712
22	1.3424227	47	1.6720978	72	1.8573325	97	1.9867717
23	1.3617278	48	1.6812412	73	1.8633229	98	1.9912261
24	1.3802112	49	1.6901961	74	1.8692317	99	1.9956352
25	1.3979400	50	1.6989700	75	1.8750613	100	2.0000000

Num.	0	1	2	3	4	5	6	7	8	9	Diff.
100	0000000	0004341	0008677	0013009	0017337	0021661	0025980	0030295	0034605	0038912	4324
101	0043214	0047511	0051805	0056094	0060379	0064660	0068937	0073209	0077478	0081742	4281
102	0086002	0090257	0094509	0098756	0102999	0107239	0111473	0115704	0119931	0124154	4240
103	0128372	0132587	0136794	0141003	0145205	0149403	0153597	0157787	0161973	0166155	4198
104	0170333	0174507	0178677	0182843	0187005	0191163	0195317	0199467	0203613	0207755	4158
105	0211893	0216027	0220157	0224284	0228406	0232524	0236639	0240750	0244857	0248960	4118
106	0253059	0257154	0261245	0265333	0269416	0273496	0277572	0281644	0285712	0289777	4080
107	0293838	0297895	0301948	0305997	0310043	0314085	0318123	0322157	0326188	0330214	4042
108	0334237	0338257	0342273	0346284	0350293	0354297	0358298	0362295	0366289	0370279	4004
109	0374265	0378247	0382226	0386202	0390173	0394141	0398105	0402066	0406023	0409977	3968
110	0413927	0417873	0421816	0425755	0429691	0433623	0437551	0441476	0445398	0449315	3932
111	0453230	0457140	0461048	0464952	0468852	0472749	0476642	0480532	0484418	0488301	3897
112	0492180	0496056	0499928	0503797	0507663	0511525	0515384	0519239	0523091	0526939	3862
113	0530784	0534626	0538464	0542299	0546130	0549958	0553783	0557605	0561423	0565237	3828
114	0569048	0572856	0576661	0580462	0584260	0588055	0591846	0595634	0599419	0603200	3795
115	0606978	0610753	0614525	0618293	0622058	0625820	0629578	0633334	0637085	0640834	3762
116	0644580	0648322	0652061	0655797	0659530	0663259	0666985	0670708	0674428	0678145	3729
117	0681859	0685569	0689276	0692980	0696681	0700379	0704073	0707765	0711453	0715138	3698
118	0718820	0722499	0726175	0729847	0733517	0737183	0740847	0744507	0748164	0751818	3666
119	0755470	0759118	0762762	0766404	0770043	0773679	0777312	0780941	0784568	0788192	3636
120	0791812	0795430	0799045	0802656	0806265	0809870	0813473	0817073	0820669	0824263	3605
121	0827854	0831441	0835026	0838608	0842187	0845763	0849336	0852906	0856473	0860037	3576
122	0863598	0867157	0870712	0874264	0877814	0881361	0884905	0888446	0891984	0895519	3547
123	0899051	0902580	0906107	0909631	0913151	0916669	0920185	0923696	0927206	0930712	3518
124	0934217	0937718	0941216	0944711	0948204	0951693	0955180	0958664	0962146	0965624	3489
125	0969100	0972573	0976043	0979511	0982975	0986437	0989896	0993353	0996806	1000257	3462
126	1003705	1007151	1010593	1014033	1017471	1020905	1024337	1027766	1031192	1034616	3434
127	1038037	1041455	1044871	1048284	1051694	1055102	1058506	1061909	1065308	1068705	3408
128	1072100	1075491	1078880	1082266	1085650	1089031	1092410	1095785	1099159	1102529	3381
129	1105897	1109262	1112625	1115985	1119343	1122698	1126050	1129400	1132746	1136091	3355
130	1139433	1142773	1146110	1149444	1152776	1156105	1159432	1162756	1166077	1169396	3329
131	1172713	1176027	1179338	1182647	1185954	1189257	1192559	1195858	1199154	1202448	3303
132	1205739	1209028	1212314	1215598	1218880	1222159	1225435	1228709	1231981	1235250	3279
133	1238516	1241780	1245042	1248301	1251558	1254813	1258064	1261314	1264561	1267806	3255
134	1271048	1274288	1277525	1280760	1283993	1287223	1290450	1293676	1296899	1300119	3230
135	1303338	1306553	1309767	1312978	1316177	1319393	1322597	1325798	1328998	1332194	3204
136	1335389	1338581	1341771	1344958	1348144	1351326	1354507	1357685	1360861	1364034	3182
137	1367206	1370374	1373541	1376705	1379867	1383027	1386184	1389339	1392492	1395643	3160
138	1398791	1401937	1405080	1408222	1411361	1414498	1417632	1420765	1423895	1427022	3137
139	1430148	1433271	1436392	1439511	1442628	1445742	1448854	1451964	1455072	1458177	3114
140	1461280	1464381	1467480	1470577	1473671	1476763	1479853	1482941	1486026	1489110	3092
141	1492191	1495270	1498347	1501422	1504494	1507564	1510632	1513698	1516762	1519824	3070

Num.	0	1	2	3	4	5	6	7	8	9	Diff.
142	1522883	1525941	1528996	1532049	1535100	1538149	1541195	1544240	1547282	1550322	3049
143	1553360	1556396	1559430	1562462	1565491	1568519	1571544	1574568	1577589	1580608	3028
144	1583625	1586640	1589653	1592663	1595672	1598678	1601683	1604685	1607686	1610684	3006
145	1613680	1616674	1619666	1622656	1625644	1628630	1631614	1634595	1637575	1640553	2986
146	1643528	1646502	1649474	1652443	1655411	1658376	1661340	1664301	1667260	1670218	2965
147	1673173	1676127	1679078	1682027	1684975	1687920	1690863	1693805	1696744	1799682	2945
148	1702617	1705550	1708482	1711411	1714339	1717264	1720188	1723110	1726029	1728947	2925
149	1731863	1734776	1737688	1740598	1743506	1746412	1749316	1752218	1755118	1758016	2906
150	1760913	1763807	1766699	1769590	1772478	1775365	1778250	1781132	1784013	1786892	2887
151	1789769	1792645	1795518	1798389	1801259	1804126	1806992	1809856	1812718	1815578	2867
152	1818436	1821292	1824146	1826999	1829850	1832698	1835545	1838390	1841233	1844075	2831
153	1846914	1849752	1852588	1855421	1858253	1861084	1863912	1866739	1896563	1872386	2829
154	1875207	1878026	1880844	1883659	1886473	1889285	1892095	1894903	1897709	1900514	2812
155	1903317	1906118	1908917	1911714	1914510	1917304	1920096	1922886	1925674	1928461	2794
156	1931246	1934029	1936810	1939590	1942367	1945143	1947917	1950690	1953460	1956229	2776
157	1958996	1961762	1964525	1967287	1970047	1972806	1975562	1978317	1981070	1983821	2759
158	1986571	1989319	1992065	1994809	1997552	2000293	2003032	2005769	2008505	2011239	2741
159	2013971	2016702	2019431	2022158	2024883	2027607	2030329	2033049	2035768	2038485	2724
160	2041200	2043913	2046625	2049335	2052044	2054750	2057455	2060159	2062869	2065560	2706
161	2068259	2070955	2073650	2076344	2079035	2081725	2084413	2087100	2089785	2092468	2690
162	2095150	2097830	2100508	2103185	2105860	2108534	2111203	2113876	2116544	2119211	2674
163	2121876	2124540	2127201	2129862	2132521	2135178	2137833	2140487	2143139	2145789	2657
164	2148438	2151086	2153732	2156376	2159018	2161659	2164298	2166936	2169572	2172206	2641
165	2174839	2177471	2180100	2182728	2185355	2187980	2190603	2193225	2195845	2198464	2625
166	2201081	2203696	2206310	2208922	2211533	2214142	2216750	2219356	2221960	2224563	2609
167	2227165	2229764	2232363	2234959	2237554	2240148	2242740	2245331	2247920	2250507	2694
168	2253093	2255677	2258260	2260841	2263421	2265999	2268576	2271151	2273724	2276296	2578
169	2278867	2281436	2284003	2286570	2289134	2291697	2294258	2296818	2299377	2301934	2563
170	2304489	2307043	2309596	2312146	2314696	2317244	2319790	2322335	2324879	2327421	2548
171	2329961	2332500	2335038	2337574	2340108	2342641	2345173	2347703	2350232	2352750	2533
172	2355284	2357809	2360331	2362853	2365373	2367891	2370408	2372923	2375437	2377950	2518
173	2380461	2382971	2385479	2387986	2390491	2392995	2395497	2397998	2400498	2402996	2504
174	2405492	2407988	2410481	2412974	2415465	2417954	2420442	2422929	2425414	2427898	2489
175	2430380	2432861	2435341	2437819	2440226	2442771	2445245	2447718	2450189	2452658	2475
176	2455127	2457593	2460059	2462523	2464986	2467447	2469907	2472365	2474823	2477278	2461
177	2479733	2482186	2484637	2487087	2489536	2491984	2494430	2496874	2499317	2501759	2448
178	2504200	2506639	2509077	2511513	2513948	2516382	2518814	2521246	2523675	2526103	2434
179	2528530	2530956	2533380	2535803	2538224	2540645	2543063	2545481	2547897	2550312	2421
180	2552725	2555137	2557548	2559957	2562365	2564772	2567177	2569581	2571984	2574386	2407
181	2576786	2579184	2581582	2583978	2586373	2588766	2591158	2593549	2595939	2598327	2393
182	2600714	2603099	2605484	2607867	2610248	2612629	2615008	2617385	2619762	2622137	2381
183	2624511	2626883	2629255	2631625	2633393	2636361	2638727	2641092	2643455	2645817	2368

Num.	0	1	2	3	4	5	6	7	8	9	Diff.
184	2648178	2650538	2652896	2655253	2657609	2659964	2662317	2664669	2667020	2669369	2355
185	2671717	2674064	2676410	2678754	2681097	2683439	2685780	2688119	2690457	2692794	2342
186	2695129	2697464	2699797	2702128	2704459	2706788	2709116	2711443	2713769	2716093	2329
187	2718416	2720738	2723058	2725378	2727696	2730013	2732328	2734643	2736956	2739268	2317
188	2741578	2743888	2746196	2748503	2750809	2753113	2755417	2757719	2760020	2762320	2304
189	2764618	2766915	2769211	2771506	2773800	2776092	2778383	2780673	2782962	2785250	2292
190	2787536	2789821	2792105	2794388	2796669	2798950	2801229	2803507	2805784	2808059	2281
191	2810334	2812607	2814879	2817150	2819419	2821688	2823955	2826221	2828486	2830750	2269
192	2833012	2835274	2837534	2839793	2842051	2844307	2846563	2848817	2851070	2853322	2256
193	2855573	2857823	2860071	2862318	2864565	2866810	2869054	2871296	2873538	2875778	2245
194	2878017	2880255	2882492	2884728	2886963	2889196	2891428	2893659	2895889	2898118	2233
195	2900346	2902573	2904798	2907022	2909246	2911468	2913688	2915908	2918127	2920344	2222
196	2922561	2924776	2926990	2929203	2931415	2933626	2935835	2938044	2940251	2942457	2211
197	2944662	2946866	2949069	2951271	2953471	2955671	2957869	2960067	2962263	2964458	2200
198	2966652	2968845	2971036	2973227	2975417	2977605	2979792	2981979	2984164	2986348	2188
199	2988531	2990713	2992893	2995073	2997251	2999429	3001605	3003781	3005955	3008128	2178
200	3010300	3012471	3014641	3016809	3018977	3021144	3023309	3025474	3027637	3029799	2167
201	3031961	3034121	3036280	3038438	3040595	3042751	3044905	3047059	3049212	3051363	2156
202	3053514	3055663	3057811	3059959	3062105	3064250	3066394	3068537	3070679	3072820	2145
203	3074960	3077099	3079237	3081374	3083509	3085644	3087778	3089910	3092042	3094172	2135
204	3096302	3098430	3100557	3102684	3104809	3106933	3109056	3111178	3113299	3115420	2124
205	3117539	3119657	3121774	3123889	3126004	3128118	3130231	3132343	3134454	3136563	2114
206	3138672	3140780	3142887	3144992	3147097	3149200	3151303	3153405	3155505	3157605	2103
207	3159703	3161801	3163897	3165993	3168087	3170181	3172273	3174365	3176455	3178545	2094
208	3180633	3182721	3184807	3186893	3188977	3191061	3193143	3195224	3197305	3199384	2084
209	3201463	3203540	3205617	3207692	3209767	3211840	3213913	3215984	3218055	3220124	2073
210	3222193	3224260	3226327	3228393	3230457	3232521	3234584	3236645	3238706	3240766	2064
211	3242825	3244882	3246939	3248995	3251050	3253104	3255157	3257209	3259260	3261310	2054
212	3263359	3265407	3267454	3269500	3271545	3273589	3275633	3277675	3279716	3281757	2044
213	3283796	3285834	3287872	3289909	3291944	3293979	3296012	3298045	3300077	3302108	2035
214	3304138	3306167	3308195	3310222	3312248	3314273	3316297	3318320	3320343	3322364	2025
215	3324385	3326404	3328423	3330440	3332457	3334473	3336488	3338501	3340514	3342526	2016
216	3344537	3346548	3348557	3350565	3352572	3354579	3356585	3358589	3360593	3362596	2006
217	3364597	3366598	3368598	3370597	3372595	3374593	3376589	3378584	3380579	3382572	1997
218	3384565	3386557	3388547	3390537	3392526	3394514	3396501	3398488	3400473	3402458	1988
219	3404441	3406424	3408405	3410386	3412366	3414345	3416323	3418301	3420277	3422252	1979
220	3424227	3426200	3428173	3430145	3432116	3434086	3436055	3438023	3439991	3441957	1970
221	3443923	3445887	3447851	3449814	3451776	3453737	3455698	3457657	3459615	3461573	1961
222	3463530	3465486	3467441	3469395	3471348	3473300	3475252	3477202	3479152	3481101	1952
223	3483049	3484996	3486942	3488887	3490832	3492775	3494718	3496660	3498601	3500541	1943
224	3502480	3504419	3506356	3508293	3510228	3512163	3514098	3516031	3517963	3519895	1934
225	3521825	3523755	3525684	3527612	3529539	3531465	3533391	3535316	3537239	3539162	1926

Num.	0	1	2	3	4	5	6	7	8	9	Diff.
226	3541084	3543006	3544926	3546845	3548764	3550682	3552599	3554515	3556430	3558345	1918
227	3560259	3562171	3564083	3565994	3567905	3569813	3571723	3573630	3575537	3577443	1908
228	3579348	3581253	3583156	3585059	3586961	3588862	3590762	3592662	3594560	3596458	1901
229	3598355	3600251	3602146	3604040	3605934	3607827	3609719	3611610	3613508	3615390	1893
230	3617278	3619166	3621053	3622939	3624825	3626709	3628593	3630476	3632358	3634239	1884
231	3636120	3638000	3639878	3641756	3643633	3645510	3647386	3649260	3651134	3653007	1877
232	3654880	3656751	3658622	3660492	3662361	3664230	3666097	3667964	3669830	3671695	1869
233	3673559	3675423	3677285	3679147	3681008	3682869	3684728	3686587	3688445	3690302	1861
234	3692159	3694014	3695869	3697723	3699576	3701428	3703280	3705131	3706981	3708830	1852
235	3710679	3712526	3714373	3716219	3718065	3719909	3721753	3723596	3725438	3727279	1844
236	3729120	3730960	3732799	3734637	3736475	3738311	3740147	3741983	3743817	3745651	1836
237	3747483	3749316	3751147	3752977	3754807	3756636	3758464	3760292	3762118	3763944	1829
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586	7678976	7679717	7680458	7681199	7681940	7682680	7683421	7684161	7684901	7685641	741
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594	7737864	7738596	7739326	7740057	7740788	7741519	7742249	7742979	7743710	7744440	731
595	7745170	7745899	7746629	7747359	7748088	7748818	7749547	7750276	7751005	7751734	730
596	7752463	7753191	7753920	7754648	7755376	7756104	7756832	7757560	7758288	7759016	728
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598	7767012	7767738	7768464	7769190	7769916	7770642	7771367	7772093	7772818	7773543	726
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602	7795965	7796686	7797408	7798129	7798850	7799571	7800291	7801012	7801732	7802453	721
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607	7831887	7832602	7833318	7834033	7834748	7835463	7836178	7836892	7837607	7838321	715
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624	7951846	7952542	7953238	7953933	7954629	7955324	7956020	7956715	7957410	7958105	696
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636	8034571	8035254	8035937	8036619	8037302	8037984	8038666	8039348	8040031	8040712	682
637	8041394	8042076	8042758	8043439	8044121	8044802	8045483	8046164	8046845	8047526	681
638	8048207	8048887	8049568	8050248	8050929	8051609	8052289	8052969	8053649	8054329	680
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641	8068580	8069258	8069935	8070612	8071290	8071967	8072643	8073320	8073997	8074674	677
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648	8115750	8116420	8117090	8117760	8118430	8119100	8119769	8120439	8121108	8121778	670
649	8122447	8123116	8123785	8124454	8125123	8125792	8126460	8127129	8127797	8128465	669
650	8129134	8129802	8130470	8131138	8131805	8132473	8133141	8133808	8134475	8135143	668
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652	8142476	8143142	8143808	8144474	8145140	8145805	8146471	8147136	8147801	8148467	666
653	8149132	8149797	8150462	8151127	8151791	8152456	8153120	8153785	8154449	8155113	665
654	8155777	8156441	8157105	8157769	8158433	8159096	8159760	8160423	8161087	8161750	664
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656	8169038	8169700	8170362	8171024	8171686	8172347	8173009	8173670	8174331	8174993	662
657	8175654	8176315	8176976	8177636	8178297	8178958	8179618	8180278	8180939	8181599	661
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659	8188854	8189513	8190172	8190831	8191489	8192148	8192806	8193465	8194123	8194781	659
660	8195439	8196097	8196755	8197413	8198071	8198728	8199386	8200043	8200700	8201358	657
661	8202015	8202672	8203328	8203985	8204642	8205298	8205955	8206611	8207268	8207924	656
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671	8267225	8267872	8268519	8269166	8269813	8270460	8271107	8271753	8272400	8273046	647
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684	8350561	8351196	8351831	8352465	8353100	8353735	8354369	8355003	8355638	8356272	635
685	8356906	8357540	8358174	8358807	8359441	360075	8360708	8361341	8361975	8362608	634
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690	8388491	8389120	8389750	8390379	8391008	8391637	8392266	8392895	8393523	8394152	629
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693	8407332	8407959	8408586	8409212	8409838	8410465	8411091	8411717	8412343	8412969	626
694	8413595	8414220	8414846	8415472	8416097	8416722	8417348	8417973	8418598	8419223	625
695	8419848	8420473	8421098	8421722	8422347	8422971	8423596	8424220	8424844	8425468	624
696	8426092	8426716	8427340	8427964	8428588	8429211	8429835	8430458	8431081	8431705	623
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698	8438554	8439176	8439798	8440420	8441042	8441664	8442286	8442907	8443529	8444150	622
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701	8457180	8457800	8458419	8459038	8459658	8460277	8460896	8461515	8462134	8462752	619
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706	8488047	8488662	8489277	8489892	8490507	8491122	8491736	8492351	8492965	8493580	614
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716	8549130	8549737	8550343	8550949	8551556	8552162	8552768	8553374	8553980	8554586	606
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721	8579353	8579955	8580557	8581159	8581761	8582363	8582965	8583567	8584169	8584770	602
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736	8668778	8669368	8669958	8670548	8671138	8671728	8672317	8672907	8673496	8674086	590
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738	8680564	8681152	8681740	8682329	8682917	8683505	8684093	8684681	8685269	8685857	588
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743	8709888	8710473	8711057	8711641	8712226	8712810	8713394	8713978	8714562	8715146	584
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747	8733206	8733788	8734369	8734950	8735531	8736112	8736693	8737274	8737855	8738435	581
748	8739016	8739597	8740177	8740757	8741338	8741918	8742498	8743078	8743658	8744238	580
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921	9642596	9643068	9643539	9644011	9644482	9644953	9645425	9645896	9646367	9646838	471
922	9647309	9647780	9648251	9648722	9649193	9649664	9650134	9650605	9651076	9651546	471
923	9652017	9652488	9652958	9653428	9653899	9654369	9654839	9655309	9655780	9656250	470
924	9656720	9657190	9657660	9658130	9658599	9659069	9659539	9660009	9660478	9660948	470
925	9661417	9661887	9662356	9662826	9663295	9663764	9664233	9664703	9665172	9665641	469
926	9666110	9666579	9667048	9667517	9667985	9668454	9668923	9669392	9669860	9670329	469
927	9670797	9671266	9671734	9672203	9672671	9673139	9673607	9674076	9674544	9675012	468
928	9675480	9675948	9676416	9676883	9677351	9677819	9678287	9678754	9679222	9679690	468
929	9680157	9680625	9681092	9681559	9682027	9682494	9682961	9683428	9683895	9684362	467
930	9684829	9685296	9685763	9686230	9686697	9687164	9687630	9688097	9688564	9689030	467
931	9689497	9689963	9690430	9690896	9691362	9691829	9692295	9692761	9693227	9693693	466
932	9694159	9694625	9695091	9695557	9696023	9696488	9696954	9697420	9697885	9698351	466
933	9698816	9699282	9699747	9700213	9700678	9701143	9701608	9702074	9702539	9703004	465
934	9703469	9703934	9704399	9704863	9705328	9705793	9706258	9706722	9707187	9707652	465
935	9708116	9708581	9709045	9709509	9709974	9710438	9710902	9711366	9711830	9712294	464
936	9712758	9713222	9713686	9714150	9714614	9715078	9715542	9716005	9716469	9716932	464
937	9717396	9717859	9718323	9718786	9719249	9719713	9720176	9720639	9721102	9721565	463
938	9722028	9722491	9722954	9723417	9723880	9724343	9724805	9725268	9725731	9726193	463
939	9726656	9727118	9727581	9728043	9728506	9728968	9729430	9729892	9730354	9730816	462

Num.	0	1	2	3	4	5	6	7	8	9	Diff.
940	9731278	9731741	9732202	9732664	9733126	9733588	9734050	9734511	9734973	9735435	462
941	9735896	9736358	9736819	9737281	9737742	9738203	9738664	9739126	9739587	9740048	461
942	9740509	9740970	9741431	9741892	9742353	9742814	9743274	9743735	9744196	9744656	461
943	9745117	9745577	9746038	9746498	9746959	9747419	9747879	9748340	9748800	9749260	460
944	9749720	9750180	9750640	9751100	9751560	9752020	9752479	9752939	9753399	9753858	460
945	9754318	9754778	9755237	9755697	9756156	9756615	9757075	9757534	9757993	9758452	459
946	9758911	9759370	9759829	9760288	9760747	9761206	9761665	9762124	9762582	9763041	459
947	9763500	9763958	9764417	9764875	9765334	9765792	9766251	9766709	9767167	9767625	458
948	9768083	9768541	9768999	9769457	9769915	9770373	9770831	9771289	9771747	9772204	458
949	9772662	9773120	9773577	9774035	9774492	9774950	9775407	9775864	9776322	9776779	458
950	9777236	9777693	9778150	9778607	9779064	9779521	9779978	9780435	9780892	9781348	457
951	9781805	9782262	9782718	9783175	9783631	9784088	9784544	9785001	9785457	9785913	457
952	9786369	9786826	9787282	9787738	9788194	9788650	9789106	9789562	9790017	9790473	456
953	9790929	9791385	9791840	9792296	9792751	9793207	9793662	9794118	9794573	9795028	456
954	9795484	9795939	9796394	9796849	9797304	9797759	9798214	9798669	9799124	9799579	455
955	9800034	9800488	9800943	9801398	9801852	9802307	9802761	9803216	9803670	9804125	455
956	9804579	9805033	9805487	9805942	9806396	9806850	9807304	9807758	9808212	9808666	454
957	9809119	9809573	9810027	9810481	9810934	9811388	9811841	9812295	9812748	9813202	454
958	9813655	9814108	9814562	9815015	9815468	9815921	9816374	9816827	9817280	9817733	453
959	9818186	9818639	9819092	9819544	9819997	9820450	9820902	9821355	9821807	9822260	453
960	9822712	9823165	9823617	9824069	9824522	9824974	9825426	9825878	9826330	9826782	452
961	9827234	9827686	9828138	9828589	9829041	9829493	9829945	9830396	9830848	9831299	452
962	9831751	9832202	9832654	9833105	9833556	9834007	9834459	9834910	9835361	9835812	451
963	9836263	9836714	9837165	9837616	9838066	9838517	9838968	9839419	9839869	9840320	451
964	9840770	9841221	9841671	9842122	9842572	9843022	9843473	9843923	9844373	9844823	450
965	9845273	9845723	9846173	9846623	9847073	9847523	9847973	9848422	9848872	9849322	450
966	9849771	9850221	9850670	9851120	9851569	9852019	9852468	9852917	9853366	9853816	450
967	9854265	9854714	9855163	9855612	9856061	9856510	9856959	9857407	9857856	9858305	449
968	9858754	9859202	9859651	9860099	9860548	9860996	9861445	9861893	9862341	9862790	448
969	9863238	9863686	9864134	9864582	9865030	9865478	9865926	9866374	9866822	9867270	448
970	9867717	9868165	9868613	9869060	9869508	9869955	9870403	9870850	9871298	9871745	447
971	9872192	9872640	9873087	9873534	9873981	9874428	9874875	9875322	9875769	9876216	447
972	9876663	9877109	9877556	9878003	9878449	9878896	9879343	9879789	9880236	9880682	447
973	9881128	9881575	9882021	9882467	9882913	9883360	9883806	9884252	9884698	9885144	446
974	9885590	9886035	9886481	9886927	9887373	9887818	9888264	9888710	9889155	9889601	446
975	9890046	9890402	9890937	9891382	9891828	9892273	9892718	9893163	9893608	9894050	445
976	9894498	9894943	9895388	9895833	9896278	9896722	9897167	9897612	9898056	9898501	445
977	9898946	9899390	9899835	9900279	9900723	9901168	9901612	9902056	9902500	9902944	444
978	9903389	9903833	9904277	9904721	9905164	9905608	9906052	9906496	9906940	9907383	444
979	9907827	9908270	9908714	9909158	9909601	9910044	9910488	9910931	9911374	9911818	443
980	9912261	9912704	9913147	9913590	9914033	9914476	9914919	9915362	9915805	9916247	443
981	9916690	9917133	9917575	9918018	9918461	9918903	9919345	9919788	9920230	9920673	443

Num.	0	1	2	3	4	5	6	7	8	9	Diff.
982	9921115	9921557	9921999	9922441	9922884	9923326	9923768	9924210	9924651	9925093	442
983	9925535	9925977	9926419	9926860	9927302	9927744	9928185	9928627	9929068	9929510	442
984	9929951	9930392	9930834	9931275	9931716	9932157	9932598	9933039	9933480	9933921	441
985	9934362	9934803	9935244	9935685	9936126	9936566	9937007	9937448	9937888	9938329	441
986	9938769	9939210	9939650	9940090	9940531	9940971	9941411	9941851	9942291	9942731	440
987	9943172	9943612	9944051	9944491	9944931	9945371	9945811	9946251	9946690	9947130	440
988	9947569	9948009	9948448	9948888	9949327	9949767	9950206	9950645	9951085	9951524	440
989	9951963	9952402	9952841	9953280	9953719	9954158	9954597	9955036	9955474	9955913	439
990	9956352	9956791	9957229	9957668	9958106	9958545	9958983	9959422	9959860	9960298	439
991	9960737	9961175	9961613	9962051	9962489	9962927	9963365	9963803	9964241	9964679	438
992	9965117	9965554	9965992	9966430	9966868	9967305	9967743	9968180	9968618	9969055	438
993	9969492	9969930	9970367	9970804	9971242	9971679	9972116	9972553	9972990	9973427	437
994	9973864	9974301	9974738	9975174	9975611	9976048	9976485	9976921	9977358	9977794	437
995	9978231	9978667	9979104	9979540	9979976	9980413	9980849	9981285	9981721	9982157	437
996	9982593	9983029	9983465	9983901	9984337	9984773	9985209	9985645	9986080	9986516	436
997	9986952	9987387	9987823	9988258	9988694	9989129	9989564	9990000	9990435	9990870	435
998	9991305	9991740	9992176	9992611	9993046	9993481	9993916	9994350	9994785	9995220	435
999	9995655	9996090	9996524	9996959	9997393	9997828	9998262	9998697	9999131	9999566	435

The END of the LOGARITHMS.

A TABLE OF Proportional Parts.

Diff.	1	2	3	4	5	6	7	8	9
44	4	9	13	18	22	26	31	35	40
46	5	9	14	18	23	28	32	37	41
48	5	10	14	19	24	29	34	38	43
50	5	10	15	20	25	30	35	40	45
52	5	10	16	21	26	31	36	42	47
54	5	11	16	22	27	32	38	43	49
56	6	11	17	22	28	34	39	45	50
58	6	12	17	23	29	35	41	46	52
60	6	12	18	24	30	36	42	48	54
62	6	12	19	25	31	37	43	50	56
64	6	13	19	26	32	38	45	51	58
66	7	13	20	26	33	40	46	53	59
68	7	14	20	27	34	41	48	54	61
70	7	14	21	28	35	42	49	57	63
72	7	14	22	29	36	43	50	58	65
74	7	15	22	30	37	44	52	59	67
76	8	15	23	30	38	46	53	61	69
78	8	16	23	31	39	47	55	62	70
80	8	16	24	32	40	48	56	64	72
82	8	16	25	33	41	49	57	66	74
84	8	17	25	34	42	50	59	67	76
86	9	17	26	34	43	52	60	69	77
88	9	18	26	35	44	53	62	70	79
90	9	18	27	36	45	54	63	72	81
92	9	18	28	37	46	55	64	74	83
94	9	19	28	38	47	56	66	75	85
96	10	19	29	38	48	58	67	77	86
98	10	20	29	39	49	59	69	78	88
100	10	20	30	40	50	60	70	80	90
102	10	20	31	41	51	61	71	82	92
104	10	21	31	42	52	62	73	83	94
106	11	21	32	42	53	64	74	85	95
108	11	22	32	43	54	65	76	86	97
110	11	22	33	44	55	66	77	88	99
112	11	22	34	45	56	67	78	90	101
114	11	23	34	46	57	68	80	91	103
116	12	23	35	46	58	70	81	93	104
118	12	24	35	47	59	71	83	94	106
120	12	24	36	48	60	72	84	96	108
122	12	24	37	49	61	73	85	97	110
124	12	25	37	50	62	74	87	99	112
126	13	25	38	50	63	76	88	101	113

Diff.	1	2	3	4	5	6	7	8	9
128	13	26	38	51	64	77	90	102	115
130	13	26	39	52	65	78	91	104	117
132	13	26	40	53	66	79	92	106	119
134	13	27	40	54	67	80	94	107	121
136	14	27	41	54	68	82	95	109	122
138	14	28	41	55	69	83	97	110	124
140	14	28	42	56	70	84	98	113	126
142	14	28	43	57	71	85	99	114	128
144	14	29	43	58	72	86	101	115	130
146	15	29	44	58	73	88	102	117	131
148	15	30	44	59	74	89	104	118	133
150	15	30	45	60	75	90	105	120	135
152	15	30	46	61	76	91	106	122	137
154	15	31	46	62	77	92	108	123	139
156	16	31	47	62	78	94	109	125	140
158	16	32	47	63	79	95	111	126	142
160	16	32	48	64	80	96	112	128	144
162	16	32	49	65	81	97	113	130	146
164	16	33	49	66	82	98	115	131	148
166	17	33	50	66	83	100	116	133	149
168	17	34	50	67	84	101	118	134	151
170	17	34	51	68	85	102	119	136	153
172	17	34	52	69	86	103	120	138	155
174	17	35	52	70	87	104	122	139	157
176	18	35	53	70	88	106	123	141	158
178	18	36	53	71	89	107	125	143	160
180	18	36	54	72	90	108	126	144	162
182	18	36	55	73	91	109	127	146	164
184	18	37	55	74	92	110	129	147	166
186	19	37	56	74	93	112	130	149	167
188	19	38	56	75	94	113	132	150	169
190	19	38	57	76	95	114	133	152	171
192	19	38	58	77	96	115	134	154	173
194	19	39	58	78	97	116	136	155	175
196	20	39	59	78	98	118	137	157	176
198	20	40	59	79	99	119	139	158	178
200	20	40	60	80	100	120	140	160	180
202	20	40	61	81	101	121	141	162	182
204	20	41	61	82	102	122	143	163	184
206	21	41	62	82	103	124	144	165	185
208	21	42	62	83	104	125	146	166	187
210	21	42	63	84	105	126	147	168	189

Diff.	1	2	3	4	5	6	7	8	9
212	21	42	64	85	106	127	148	170	191
214	21	43	64	86	107	128	150	171	193
216	22	43	65	86	108	130	151	173	194
218	22	44	65	87	109	131	153	174	196
220	22	44	66	88	110	132	154	176	198
222	22	44	67	89	111	133	155	178	200
224	22	45	67	90	112	134	157	179	202
226	23	45	68	90	113	136	158	181	203
228	23	46	68	91	114	137	160	182	205
230	23	46	69	92	115	138	161	184	207
232	23	46	70	93	116	139	162	186	209
234	23	47	70	94	117	140	164	187	211
236	24	47	71	94	118	142	165	189	212
238	24	48	71	95	119	143	167	190	214
240	24	48	72	96	120	144	168	192	216
242	24	48	73	97	121	145	169	194	218
244	24	49	73	98	122	146	171	195	220
246	25	49	74	98	123	148	172	197	221
248	25	50	74	99	124	149	174	198	223
250	25	50	75	100	125	150	175	200	225
252	25	50	76	101	126	151	176	202	227
254	25	51	76	102	127	152	177	203	229
256	26	51	77	102	128	154	179	205	230
258	26	52	77	103	129	155	181	206	232
260	26	52	78	104	130	156	182	208	234
262	26	52	79	105	131	157	183	210	236
264	26	53	79	106	132	158	185	211	238
266	27	53	80	106	133	160	186	213	239
268	27	54	80	107	134	161	188	214	241
270	27	54	81	108	135	162	189	216	243
272	27	54	82	109	136	163	190	218	245
274	27	55	82	110	137	164	192	219	247
276	28	55	83	110	138	166	193	221	248
278	28	56	83	111	139	167	195	222	250
280	28	56	84	112	140	168	196	224	252
282	28	56	85	113	141	169	197	226	254
284	28	57	85	114	142	170	199	227	256
286	29	57	86	114	143	172	200	229	257
288	29	58	86	115	144	173	202	230	259
290	29	58	87	116	145	174	203	232	261
292	29	58	88	117	146	175	204	234	263
294	29	59	88	118	147	176	206	235	265

Diff.	1	2	3	4	5	6	7	8	9
296	30	59	89	118	148	178	207	237	267
298	30	60	89	119	149	179	209	238	268
300	30	60	90	120	150	180	210	240	270
302	30	60	91	121	151	181	211	242	272
304	30	61	91	121	152	182	213	243	274
306	31	61	92	122	153	184	214	245	275
308	31	62	92	123	154	185	216	246	277
310	31	62	93	124	155	186	217	248	279
312	31	62	94	125	156	187	218	250	281
314	31	63	94	126	157	188	220	251	283
316	32	63	95	126	158	190	221	253	284
318	32	64	95	127	159	191	223	254	286
320	32	64	96	128	160	192	224	256	288
322	32	64	97	129	161	193	225	258	290
324	32	65	97	130	162	194	227	259	292
326	33	65	98	130	163	196	228	261	293
328	33	66	98	131	164	197	230	262	295
330	33	66	99	132	165	198	231	264	297
332	33	66	100	133	166	199	232	266	299
334	33	67	100	134	167	200	234	267	301
336	34	67	101	134	168	202	235	269	302
338	34	68	101	135	169	203	237	270	304
340	34	68	102	136	170	204	238	272	306
342	34	68	103	137	171	205	239	274	308
344	34	69	103	138	172	206	241	275	310
346	35	69	104	138	173	208	242	277	311
348	35	70	104	139	174	209	244	278	313
350	35	70	105	140	175	210	245	280	315
352	35	70	106	141	176	211	246	282	317
354	35	71	106	142	177	212	248	283	319
356	36	71	107	142	178	214	249	285	320
358	36	72	107	143	179	215	251	286	322
360	36	72	108	144	180	216	252	288	324
362	36	72	109	145	181	217	253	290	326
364	36	73	109	146	182	218	255	291	328
366	37	73	110	146	183	220	256	293	329
368	37	74	110	147	184	221	258	294	331
370	37	74	111	148	185	222	259	296	333
372	37	74	112	149	186	223	260	298	335
374	37	75	112	150	187	224	262	299	337
376	38	75	113	150	188	226	263	301	338
378	38	76	113	151	189	227	265	303	339

Diff.	1	2	3	4	5	6	7	8	9
380	38	76	114	152	190	228	266	304	342
382	38	76	115	153	191	229	267	306	344
384	38	77	115	154	192	230	269	307	346
386	39	77	116	154	193	232	270	309	347
388	39	78	116	155	194	233	272	310	349
390	39	78	117	156	195	234	273	312	351
392	39	78	118	157	196	235	274	314	353
394	39	79	118	158	197	236	276	315	355
396	40	79	119	158	198	238	277	317	356
398	40	80	119	159	199	239	279	318	358
400	40	80	120	160	200	240	280	320	360
402	40	80	121	161	201	241	281	322	362
404	40	81	121	162	202	242	283	313	364
406	41	81	122	162	203	244	284	325	365
408	41	82	122	163	204	245	286	326	367
410	41	82	123	164	205	246	287	328	369
412	41	82	124	165	206	247	288	330	371
414	41	83	124	166	207	248	290	331	373
416	42	83	125	166	208	250	291	333	374
418	42	84	125	167	209	251	293	334	376
420	42	84	126	168	210	252	294	336	378
422	42	84	127	169	211	253	295	338	380
424	42	85	127	170	212	254	297	339	382
426	43	85	128	170	213	256	298	341	383
428	43	86	128	171	214	257	300	342	385
430	43	86	129	172	215	258	301	344	387
432	43	86	130	173	216	259	302	346	389
434	43	87	130	174	217	260	304	347	391
436	44	87	131	174	218	262	305	349	392
438	44	88	131	175	219	263	307	350	394
440	44	88	132	176	220	264	308	352	396
442	44	88	133	177	221	265	309	354	398
444	44	89	133	178	222	266	311	355	400
446	45	89	134	178	223	268	312	357	401
448	45	90	134	179	224	269	314	358	403
450	45	90	135	180	225	270	315	360	405
452	45	90	136	181	226	271	316	362	407
454	45	91	136	182	227	272	318	363	409
456	46	91	137	182	228	274	[illegible]	365	410
458	46	92	137	183	229	275	[illegible]	366	412
460	46	92	138	184	230	276	[illegible]	368	414
462	46	92	139	185	231	[illegible]	[illegible]	370	416

Diff.	1	2	3	4	5	6	7	8	9
464	46	93	139	186	232	278	325	371	418
466	47	93	140	186	233	280	326	373	419
468	47	94	140	187	234	281	328	374	421
470	47	94	141	188	235	282	329	376	423
472	47	94	142	189	236	283	330	378	425
474	47	95	142	190	237	284	332	379	427
476	48	95	143	190	238	286	333	381	428
478	48	96	143	191	239	287	335	382	430
480	48	96	144	192	240	288	336	384	432
482	48	96	145	193	241	289	337	386	434
484	48	97	145	194	242	290	339	387	436
486	49	97	146	194	243	292	340	389	437
488	49	98	146	195	244	293	342	390	439
490	49	98	147	196	245	294	343	392	441
492	49	98	148	197	246	295	344	394	443
494	49	99	148	198	247	296	346	395	445
496	50	99	149	198	248	298	347	397	446
498	50	100	149	199	249	299	349	398	448
500	50	100	150	200	250	300	350	400	450
502	50	100	151	201	251	301	351	402	452
504	50	101	151	202	252	302	353	403	454
506	51	101	152	202	253	304	354	405	455
508	51	102	152	203	254	305	356	406	457
510	51	102	153	204	255	306	357	408	459
512	51	102	154	205	256	307	358	410	461
514	51	103	154	206	257	308	360	411	463
516	52	103	155	206	258	310	361	413	464
518	52	104	155	207	259	311	363	414	466
520	52	104	156	208	260	312	364	416	468
522	52	104	157	209	261	313	365	418	470
524	52	105	157	210	262	314	367	419	472
526	53	105	158	210	263	316	368	421	473
528	53	106	158	211	264	317	370	422	475
530	53	106	159	212	265	318	371	424	477
532	53	106	160	213	266	319	372	426	479
534	53	107	160	214	267	320	374	427	481
536	54	107	161	214	268	322	375	429	482
538	54	108	161	215	269	323	377	430	484
540	54	108	162	216	270	324	378	432	486
542	54	108	163	217	271	325	379	434	488
544	54	109	163	218	272	326	381	435	490
546	55	109	164	218	273	328	382	437	491

Diff.	1	2	3	4	5	6	7	8	9
548	55	110	164	219	274	329	384	438	493
550	55	110	165	220	275	330	385	440	495
552	55	110	166	221	276	331	386	442	497
554	55	111	166	222	277	332	388	443	499
556	56	111	167	222	278	334	389	445	500
558	56	112	167	223	279	335	391	446	502
560	56	112	168	224	280	336	392	448	504
562	56	112	169	225	281	337	393	450	506
564	56	113	169	226	282	338	395	451	508
566	57	113	170	226	283	340	396	453	509
568	57	114	170	227	284	341	398	454	511
570	57	114	171	228	285	342	399	456	513
572	57	114	172	229	286	343	400	458	515
574	57	115	172	230	287	344	401	459	516
576	58	115	173	230	288	346	403	461	518
578	58	116	173	231	289	347	405	462	520
580	58	116	174	232	290	348	406	464	522
582	58	116	175	233	291	349	407	466	524
584	58	117	175	234	292	350	409	467	526
586	59	117	176	234	293	352	410	469	527
588	59	118	176	235	294	353	412	470	529
590	59	118	177	236	295	354	413	472	531
592	59	118	178	237	296	355	414	474	533
594	59	119	178	238	297	356	416	475	535
596	60	119	179	238	298	358	417	477	536
598	60	120	179	239	299	359	419	478	538
600	60	120	180	240	300	360	420	480	540
602	60	120	181	241	301	361	421	482	542
604	60	121	181	242	302	362	423	483	544
606	61	121	182	242	303	364	424	485	545
608	61	122	182	243	304	365	426	486	547
610	61	122	183	244	305	366	427	488	549
612	61	122	184	245	306	367	428	490	551
614	61	123	184	246	307	368	430	491	553
616	62	123	185	246	308	370	431	493	554
618	62	124	185	247	309	371	433	494	556
620	62	124	186	248	310	372	434	496	558
622	62	124	187	249	311	373	435	498	560
624	62	125	187	250	312	374	437	499	562
626	63	125	188	250	313	376	438	501	563
628	63	126	188	251	314	377	440	502	565
630	63	126	189	252	315	378	441	504	567

Diff.	1	2	3	4	5	6	7	8	9
632	63	126	190	253	316	379	442	506	569
634	63	127	190	254	317	380	444	507	571
636	64	127	191	254	318	382	445	509	572
638	64	128	191	255	319	383	447	510	574
640	64	128	192	256	320	384	448	512	576
642	64	128	193	257	321	385	449	514	578
644	64	129	193	258	322	386	451	515	580
646	65	129	194	258	323	388	452	517	581
648	65	130	194	259	324	389	454	518	583
650	65	130	195	260	325	390	455	520	585
652	65	130	196	261	326	391	456	522	587
654	65	131	196	262	327	392	458	523	589
656	66	131	197	262	328	394	459	525	590
658	66	132	197	263	329	395	461	526	592
660	66	132	198	264	330	396	462	528	594
662	66	132	199	265	331	397	463	530	596
664	66	133	199	266	332	398	465	531	598
666	67	133	200	266	333	400	466	533	599
668	67	134	200	267	334	401	468	534	601
670	67	134	211	268	335	402	469	536	603
672	67	134	222	269	336	403	470	538	605
674	67	135	222	270	337	404	472	539	607
676	68	135	223	270	338	406	473	541	608
678	68	136	223	271	339	407	475	542	610
680	68	136	224	272	340	408	476	544	612
682	68	136	225	273	341	409	477	546	614
684	68	137	225	274	342	410	479	547	616
686	69	137	226	274	343	412	480	549	617
688	69	138	226	275	344	413	482	550	619
690	69	138	227	276	345	414	483	552	621
692	69	138	228	277	346	415	484	554	623
694	69	139	228	278	347	416	486	555	625
696	70	139	229	278	348	417	487	557	626
698	70	140	229	279	349	419	489	558	628
700	70	140	230	280	350	420	490	560	630
702	70	140	231	281	351	421	491	562	632
704	70	141	231	282	352	422	492	563	634
706	71	141	232	282	353	424	494	565	635
708	71	142	232	283	354	425	496	566	637
710	71	142	233	284	355	426	497	568	639
712	71	142	234	285	356	427	498	570	641
714	71	143	234	286	357	428	500	571	643

Diff.	1	2	3	4	5	6	7	8	9
716	72	143	215	286	358	430	501	573	644
718	72	144	215	287	359	431	503	574	646
720	72	144	216	288	360	432	504	576	648
722	72	144	217	289	361	433	505	578	650
724	72	145	217	290	362	434	507	579	652
726	73	145	218	290	363	436	508	581	653
728	73	146	218	291	364	437	510	582	655
730	73	146	219	292	365	438	511	584	657
732	73	146	220	293	366	439	512	586	659
734	73	147	220	294	367	440	514	587	661
736	74	147	221	294	368	442	515	589	662
738	74	148	221	295	369	443	517	590	664
740	74	148	222	296	370	444	518	592	666
742	74	148	223	297	371	445	519	594	668
744	74	149	223	298	372	446	521	595	670
746	75	149	224	298	373	448	522	597	671
748	75	150	224	299	374	449	524	598	673
750	75	150	225	300	375	450	525	600	675
752	75	150	226	301	376	451	526	602	677
754	75	151	226	302	377	452	528	603	679
756	76	151	227	302	378	454	529	605	680
758	76	152	227	303	379	455	531	606	682
760	76	152	228	304	380	456	532	608	684
762	76	152	229	305	381	457	533	610	686
764	76	153	229	306	382	458	535	611	688
766	77	153	230	306	383	460	536	613	689
768	77	154	230	307	384	461	538	614	691
770	77	154	231	308	385	462	539	616	693
772	77	154	232	309	386	463	540	618	695
774	77	155	232	310	387	464	542	619	697
776	78	155	233	310	388	466	543	621	699
778	78	156	233	311	389	467	545	622	700
780	78	156	234	312	390	468	546	624	702
782	78	156	235	313	391	469	547	626	704
784	78	157	235	314	392	470	549	627	706
786	79	157	236	314	393	472	550	629	707
788	79	158	236	315	394	473	552	630	709
790	79	158	237	316	395	474	553	632	711
792	79	158	238	317	396	475	554	634	713
794	79	159	238	318	397	477	556	635	715
796	80	159	239	318	398	478	557	637	717
798	80	160	239	319	399	479	559	638	718

Diff.	1	2	3	4	5	6	7	8	9
800	80	160	240	320	400	480	560	640	720
802	80	160	241	321	401	481	561	642	722
804	80	161	241	322	402	482	563	643	724
806	81	161	242	322	403	484	564	645	725
808	81	162	242	323	404	485	566	646	727
810	81	162	243	324	405	486	567	648	729
812	81	162	244	325	406	487	568	650	731
814	81	163	244	326	407	488	570	651	733
816	82	163	245	326	408	490	571	653	734
818	82	164	245	327	409	491	572	654	736
820	82	164	246	328	410	492	574	650	738
822	82	164	247	329	411	493	575	658	740
824	82	165	247	330	412	494	577	659	742
826	83	165	248	330	413	496	578	661	743
828	83	166	248	331	414	497	580	662	745
830	83	166	249	332	415	498	581	664	747
832	83	166	250	333	416	499	582	666	749
834	83	167	250	334	417	500	584	667	751
836	84	167	251	334	418	502	585	669	753
838	84	168	251	335	419	503	587	670	754
840	84	168	252	336	420	504	588	672	756
842	84	168	253	337	421	505	589	674	758
844	84	169	253	338	422	506	591	675	760
846	85	169	254	338	423	508	592	677	761
848	85	170	254	339	424	509	594	678	763
850	85	170	255	340	425	510	595	680	765
852	85	170	256	341	426	511	596	682	767
854	85	171	256	342	427	512	598	683	769
856	86	171	257	342	428	514	599	685	771
858	86	172	257	343	429	515	601	686	773
860	86	172	258	344	430	516	602	688	774
862	86	172	259	345	431	517	603	690	776
864	86	173	259	346	432	518	605	691	778
866	87	173	260	346	433	520	606	693	779
868	87	174	260	347	434	521	608	694	781
870	87	174	261	348	435	522	609	696	783
872	87	174	262	349	436	523	611	698	785
874	87	175	262	350	437	524	612	699	787
876	88	175	263	350	438	526	613	701	789
878	88	176	263	351	439	527	615	702	791
880	88	176	264	352	440	528	616	704	793
882	88	176	265	353	441	529	617	706	795

Diff.	1	2	3	4	5	6	7	8	9
884	88	177	265	354	442	530	619	707	796
886	89	177	266	354	443	532	620	709	797
888	89	178	266	355	444	533	622	710	799
890	89	178	267	356	445	534	623	712	801
892	89	178	268	357	446	535	624	714	803
894	89	179	268	358	447	536	626	715	805
896	90	179	269	358	448	538	627	717	806
898	90	180	269	359	449	539	629	718	808
900	90	180	270	360	450	540	630	720	810
903	90	181	271	361	451	542	632	722	813
906	91	181	272	362	453	544	634	725	815
909	91	182	273	364	454	545	636	727	818
912	91	182	274	365	456	547	638	730	821
915	91	183	274	366	457	549	640	732	823
918	92	184	275	367	459	551	643	734	826
921	92	184	276	368	460	553	645	737	829
924	92	185	277	370	462	554	647	739	832
927	93	185	278	371	463	556	649	742	834
930	93	186	279	372	465	558	651	744	837
933	93	187	280	373	466	560	653	746	839
936	94	187	281	374	468	562	655	749	842
939	94	188	282	376	469	563	657	751	845
942	94	188	283	377	471	565	659	754	848
945	94	189	283	378	472	567	661	756	850
948	95	190	284	379	474	569	664	758	853
951	95	190	285	380	475	571	666	761	856
954	95	191	286	382	477	572	668	763	859
957	96	191	287	383	478	574	670	766	861
960	96	192	288	384	480	576	672	768	864
963	96	193	289	385	481	578	674	770	867
966	97	193	290	386	483	580	676	773	869
969	97	194	291	388	484	581	678	775	872
972	97	194	292	389	486	583	680	778	875
975	97	195	292	390	487	585	682	780	878
978	98	196	293	391	489	587	685	782	880
981	98	196	294	392	490	589	687	785	883
984	98	197	295	394	492	590	689	787	886
987	99	197	296	395	493	592	691	790	888
990	99	198	297	396	495	594	693	792	891
993	99	199	298	397	496	596	695	794	894
996	99	199	299	398	498	598	697	797	897
999	100	200	300	400	499	599	699	799	899

Diff.	1	2	3	4	5	6	7	8	9
1005	100	201	301	402	502	603	703	804	904
1009	101	202	303	404	504	605	706	807	908
1013	101	203	304	405	506	608	709	810	912
1017	102	203	305	407	508	610	712	814	915
1021	102	204	306	408	510	613	715	817	919
1025	102	205	307	410	512	615	717	820	923
1029	103	206	309	412	514	617	720	823	926
1033	103	207	310	413	516	620	723	826	930
1037	104	207	311	415	518	622	726	830	933
1041	104	208	312	416	520	625	729	833	937
1045	104	209	313	418	522	627	731	836	941
1049	105	210	315	420	524	629	734	839	944
1053	105	211	316	421	526	632	737	842	948
1057	106	211	317	423	528	634	740	846	951
1061	106	212	318	424	530	637	743	849	955
1065	106	213	319	426	532	639	745	852	959
1069	107	214	321	428	534	641	748	855	962
1073	107	215	322	429	536	644	751	858	966
1077	108	215	323	431	538	646	754	862	969
1081	108	216	324	432	540	649	757	865	973
1085	108	217	325	434	542	651	759	868	977
1089	109	218	327	436	544	653	762	871	980
1093	109	219	328	437	546	656	765	874	984
1097	110	219	329	439	548	658	768	878	987
1101	110	220	330	440	550	661	771	881	991
1105	110	221	331	442	552	663	773	884	994
1109	111	222	333	444	554	665	776	887	998
1113	111	223	334	445	556	668	779	890	1002
1117	112	223	335	447	558	670	782	894	1005
1121	112	224	336	448	560	673	785	897	1009
1125	112	225	337	450	562	675	787	900	1013
1129	113	226	339	452	564	677	790	903	1016
1133	113	227	340	453	566	680	793	906	1020
1137	114	227	341	455	568	682	796	910	1023
1141	114	228	342	456	570	685	799	913	1027
1145	114	229	343	458	572	687	801	916	1031
1149	115	230	345	460	574	689	804	919	1034
1153	115	231	346	461	576	692	807	922	1038
1157	116	231	347	463	578	694	810	926	1041
1161	116	232	348	464	580	697	813	929	1045
1165	116	233	349	466	582	699	815	932	1049
1169	117	234	351	468	584	701	818	935	1052

Diff.	1	2	3	4	5	6	7	8	9
1173	117	235	352	469	586	704	821	938	1056
1177	118	235	353	471	588	706	824	942	1059
1181	118	236	354	472	590	709	827	945	1063
1185	118	237	355	474	592	711	829	948	1067
1189	119	238	357	476	594	713	832	951	1070
1193	119	239	358	477	596	716	835	954	1074
1197	120	239	359	479	598	718	838	958	1077
1201	120	240	360	480	600	721	841	961	1081
1205	120	241	361	482	602	723	843	964	1084
1209	121	242	363	484	604	725	846	967	1088
1213	121	243	364	485	606	728	849	970	1092
1217	122	243	365	487	608	730	852	974	1095
1221	122	244	366	488	610	732	855	977	1099
1225	122	245	367	490	612	735	857	980	1102
1229	123	246	369	492	614	737	860	983	1106
1233	123	247	370	493	616	740	863	986	1110
1237	124	247	371	495	618	742	866	990	1113
1241	124	248	372	496	620	745	869	[illegible]	1117
1245	124	249	373	498	622	747	871	996	1120
1249	125	250	375	500	624	749	874	999	1124
1253	125	251	376	501	626	752	877	1002	1128
1257	126	251	377	503	628	754	880	1006	1131
1260	126	252	378	504	630	756	882	1008	1134
1263	126	253	379	505	631	758	884	1010	1137
1267	127	253	380	507	633	760	887	1014	1140
1271	127	254	381	508	635	763	890	1017	1144
1275	127	255	382	510	637	765	892	1020	1147
1279	128	256	384	512	639	767	895	1023	1151
1283	128	257	385	513	641	770	898	1026	1155
1287	129	257	386	515	643	772	901	1030	1158
1291	129	258	387	516	645	775	904	1033	1162
1295	129	259	388	518	647	777	906	1036	1165
1299	130	260	389	520	649	779	909	1039	1169
1303	130	261	391	521	651	782	912	1042	1173
1307	131	261	392	523	653	784	915	1046	1176
1311	131	262	393	524	655	787	918	1049	1180
1315	131	263	394	526	657	789	920	1052	1183
1319	132	264	396	528	659	791	923	1055	1187
1323	132	265	397	529	661	794	926	1058	1191
1327	133	265	398	531	663	796	929	1062	1194
1331	133	266	399	532	665	799	932	1065	1198
1335	133	267	400	534	667	801	934	1068	1201

Diff.	1	2	3	4	5	6	7	8	9
1339	134	268	402	536	669	803	937	1071	1205
1343	134	269	403	537	671	806	940	1074	1209
1347	135	269	404	539	673	808	943	1078	1212
1351	135	270	405	540	675	811	946	1081	1216
1355	135	271	406	542	677	813	948	1084	1219
1359	136	272	408	544	679	815	951	1087	1223
1363	136	273	409	545	681	818	954	1090	1227
1367	137	273	410	547	683	820	957	1094	1230
1371	137	274	411	548	685	823	960	1097	1234
1375	137	275	412	550	687	825	962	1100	1237
1379	138	276	414	552	689	827	965	1103	1241
1383	138	277	415	553	691	830	968	1106	1245
1387	139	277	416	555	693	832	971	1110	1248
1391	139	278	417	556	695	835	974	1113	1252
1395	140	279	418	558	697	837	976	1116	1255
1399	140	280	420	559	699	839	979	1119	1259
1403	140	281	421	561	701	842	982	1122	1263
1407	141	281	422	563	703	844	985	1126	1266
1411	141	282	423	564	705	847	988	1129	1270
1415	141	283	424	566	707	849	990	1132	1273
1420	142	284	426	568	710	852	994	1136	1278
1425	142	285	427	570	712	855	997	1140	1282
1430	143	286	429	572	715	858	1001	1144	1287
1435	143	287	430	574	717	861	1004	1148	1291
1440	144	288	432	576	720	864	1008	1152	1296
1445	144	289	433	578	722	867	1011	1156	1300
1450	145	290	435	580	725	870	1015	1160	1305
1455	145	291	436	582	727	873	1018	1164	1309
1460	146	292	438	584	730	876	1022	1168	1314
1465	146	293	439	586	732	879	1025	1172	1318
1470	147	294	441	588	735	882	1029	1176	1323
1475	147	295	442	590	737	885	1032	1180	1327
1480	148	296	444	592	740	888	1036	1184	1332
1485	148	297	445	594	742	891	1039	1188	1336
1490	149	298	447	596	745	894	1043	1192	1341
1495	149	299	448	598	747	897	1046	1196	1345
1500	150	300	450	600	750	900	1050	1200	1350
1505	150	301	451	602	752	903	1053	1204	1354
1510	151	302	453	604	755	906	1057	1208	1359
1515	151	303	454	606	757	909	1060	1212	1363
1520	152	304	456	608	760	912	1064	1216	1368
1525	152	305	457	610	762	915	1067	1220	1372

Diff.	1	2	3	4	5	6	7	8	9
1530	153	306	459	612	765	918	1071	1224	1377
1535	153	307	460	614	767	921	1074	1228	1381
1540	154	308	462	616	770	924	1078	1232	1386
1545	154	309	463	618	772	927	1081	1236	1390
1550	155	310	465	620	775	930	1085	1240	1395
1555	155	311	466	622	777	933	1088	1244	1399
1560	156	312	468	624	780	936	1092	1248	1404
1565	156	313	469	626	782	939	1095	1252	1408
1570	157	314	471	628	785	942	1099	1256	1413
1575	157	315	472	630	787	945	1102	1260	1417
1580	158	316	474	632	790	948	1106	1264	1422
1585	158	317	475	634	792	951	1109	1268	1426
1590	159	318	477	636	795	954	1113	1272	1431
1595	159	319	478	638	797	957	1116	1276	1435
1600	160	320	480	640	800	960	1120	1280	1440
1605	160	321	481	642	802	963	1123	1284	1444
1610	161	322	483	644	805	966	1127	1288	1449
1615	161	323	484	646	807	969	1130	1292	1453
1620	162	324	486	648	810	972	1134	1296	1458
1625	162	325	487	650	812	975	1137	1300	1462
1630	163	326	489	652	815	978	1141	1304	1467
1635	163	327	490	654	817	981	1144	1308	1471
1640	164	328	492	656	820	984	1148	1312	1476
1645	164	329	493	658	822	987	1151	1316	1480
1650	165	330	495	660	825	990	1155	1320	1485
1655	165	331	496	662	827	993	1158	1324	1489
1660	166	332	498	664	830	996	1162	1328	1494
1665	166	333	499	666	832	999	1165	1332	1498
1670	167	334	501	668	835	1002	1169	1336	1503
1675	167	335	502	670	837	1005	1172	1340	1507
1680	168	336	504	672	840	1008	1176	1344	1512
1685	168	337	505	674	842	1011	1179	1348	1516
1690	169	338	507	676	845	1014	1183	1352	1521
1695	169	339	508	678	847	1017	1186	1356	1525
1700	170	340	510	680	850	1020	1190	1360	1530
1705	170	341	511	682	852	1023	1193	1364	1534
1710	171	342	513	684	855	1026	1197	1368	1539
1715	171	343	514	686	857	1029	1200	1372	1543
1720	172	344	516	688	860	1032	1204	1376	1548
1725	172	345	517	690	862	1035	1207	1380	1552
1730	173	346	519	692	865	1038	1211	1384	1557
1735	173	347	520	694	867	1041	1214	1388	1561

Diff.	1	2	3	4	5	6	7	8	9
1740	174	348	522	696	870	1044	1218	1392	1566
1745	174	349	523	698	872	1047	1221	1396	1570
1750	175	350	525	700	875	1050	1225	1400	1575
1755	175	351	526	702	877	1053	1228	1404	1579
1760	176	352	528	704	880	1056	1232	1408	1584
1765	176	353	529	706	882	1059	1235	1412	1588
1770	177	354	531	708	885	1062	1239	1416	1593
1775	177	355	532	710	887	1065	1242	1420	1597
1780	178	356	534	712	890	1068	1246	1424	1602
1785	178	357	535	714	892	1071	1249	1428	1606
1790	179	358	537	716	895	1074	1253	1432	1611
1795	179	359	538	718	897	1077	1256	1436	1615
1800	180	360	540	720	900	1080	1260	1440	1620
1805	180	361	541	722	902	1083	1263	1444	1624
1810	181	362	543	724	905	1086	1267	1448	1629
1815	181	363	544	726	907	1089	1270	1452	1633
1820	182	364	546	728	910	1092	1274	1456	1638
1825	182	365	547	730	912	1095	1277	1460	1642
1830	183	366	549	732	915	1098	1281	1464	1647
1835	183	367	550	734	917	1101	1284	1468	1651
1840	184	368	552	736	920	1104	1288	1472	1656
1845	184	369	553	738	922	1107	1291	1476	1660
1850	185	370	555	740	925	1110	1295	1480	1665
1855	185	371	556	742	927	1113	1298	1484	1669
1860	186	372	558	744	930	1116	1302	1488	1674
1865	186	373	559	746	932	1119	1305	1492	1678
1870	187	374	561	748	935	1122	1309	1496	1683
1875	187	375	562	750	937	1125	1312	1500	1687
1880	188	376	564	752	940	1128	1316	1504	1692
1885	188	377	565	754	942	1131	1319	1508	1696
1890	189	378	567	756	945	1134	1323	1512	1701
1895	189	379	568	758	947	1137	1326	1516	1705
1900	190	380	570	760	950	1140	1330	1520	1710
1905	190	381	571	762	952	1143	1333	1524	1714
1910	191	382	573	764	955	1146	1337	1528	1719
1915	191	383	574	766	957	1149	1340	1532	1723
1920	192	384	576	768	960	1152	1344	1536	1728
1925	192	385	577	770	962	1155	1347	1540	1732
1930	193	386	579	772	965	1158	1351	1544	1737
1935	193	387	580	774	967	1161	1354	1548	1741
1940	194	388	582	776	970	1164	1358	1552	1746
1945	194	389	583	778	972	1167	1361	1556	1750

Diff.	1	2	3	4	5	6	7	8	9
1950	195	390	585	780	975	1170	1365	1560	1755
1955	195	391	586	782	977	1173	1368	1564	1759
1960	196	392	588	784	980	1176	1372	1568	1764
1965	196	393	589	786	982	1179	1375	1572	1768
1970	197	394	591	788	985	1182	1379	1576	1773
1975	197	395	592	790	987	1185	1382	1580	1777
1980	198	396	594	792	990	1188	1386	1584	1782
1985	198	397	595	794	992	1191	1389	1588	1786
1990	199	398	597	796	995	1194	1393	1592	1791
1995	199	399	598	798	997	1197	1396	1596	1795
2000	200	400	600	800	1000	1200	1400	1600	1800
2010	201	402	603	804	1005	1206	1407	1608	1809
2020	202	404	606	808	1010	1212	1414	1616	1818
2030	203	405	609	812	1015	1218	1421	1624	1827
2040	204	408	612	816	1020	1224	1428	1632	1836
2050	205	410	615	820	1025	1230	1435	1640	1845
2060	206	412	618	824	1030	1236	1442	1648	1854
2070	207	414	621	828	1035	1242	1449	1656	1863
2080	208	416	625	832	1040	1248	1456	1664	1872
2090	209	418	627	836	1045	1254	1463	1672	1881
2100	210	420	630	840	1050	1260	1470	1680	1890
2110	211	422	633	844	1055	1266	1477	1688	1899
2120	212	424	636	848	1060	1272	1484	1696	1908
2130	213	426	639	852	1065	1278	1491	1604	1917
2140	214	428	642	856	1070	1284	1498	1712	1926
2150	215	430	645	860	1075	1290	1505	1720	1935
2160	216	432	648	864	1080	1296	1512	1728	1944
2170	217	434	651	868	1085	1302	1519	1736	1953
2180	218	436	654	872	1090	1308	1526	1744	1962
2190	219	438	657	876	1095	1314	1533	1752	1971
2200	220	440	660	880	1100	1320	1540	1760	1980
2210	221	442	663	884	1105	1326	1547	1768	1989
2220	222	444	666	888	1110	1332	1554	1776	1998
2230	223	446	669	892	1115	1338	1561	1784	2007
2240	224	448	672	896	1120	1344	1568	1792	2016
2250	225	450	675	900	1125	1350	1575	1800	2025
2260	226	452	678	904	1130	1356	1582	1808	2034
2270	227	454	681	908	1135	1362	1589	1816	2043
2280	228	456	684	912	1140	1368	1596	1824	2052
2290	229	458	687	916	1145	1374	1603	1832	2061
2300	230	460	690	920	1150	1380	1610	1840	2070
2310	231	462	693	924	1155	1386	1617	1848	2079

Diff.	1	2	3	4	5	6	7	8	9
2320	232	464	696	928	1160	1392	1624	1856	2088
2330	233	466	699	932	1165	1398	1631	1864	2097
2340	234	468	702	936	1170	1404	1638	1872	2106
2350	235	470	705	940	1175	1410	1645	1880	2115
2360	236	472	708	944	1180	1416	1652	1888	2124
2370	237	474	711	948	1185	1422	1659	1896	2133
2380	238	476	714	952	1190	1428	1666	1904	2142
2390	239	478	717	956	1195	1434	1673	1912	2151
2400	240	480	720	960	1200	1440	1680	1920	2160
2410	241	482	723	964	1205	1446	1687	1928	2169
2420	242	484	726	968	1210	1452	1694	1936	2178
2430	243	486	729	972	1215	1458	1701	1944	2187
2440	244	488	732	976	1220	1464	1708	1952	2196
2450	245	490	735	980	1225	1470	1715	1960	2205
2460	246	492	738	984	1230	1476	1722	1968	2214
2470	247	494	741	988	1235	1482	1729	1976	2223
2480	248	496	744	992	1240	1488	1736	1984	2232
2490	249	498	747	996	1245	1494	1743	1992	2241
2500	250	500	750	1000	1250	1500	1750	2000	2250
2510	251	502	753	1004	1255	1506	1757	2008	2259
2520	252	504	756	1008	1260	1512	1764	2016	2268
2530	253	506	759	1012	1265	1518	1771	2024	2277
2540	254	508	762	1016	1270	1524	1778	2032	2286
2550	255	510	765	1020	1275	1530	1785	2040	2295
2560	256	512	768	1024	1280	1536	1792	2048	2304
2570	257	514	771	1028	1285	1542	1799	2056	2313
2580	258	516	774	1032	1290	1548	1806	2064	2322
2590	259	518	777	1036	1295	1554	1813	2072	2331
2600	260	520	780	1040	1300	1560	1820	2080	2340
2610	261	522	783	1044	1305	1566	1827	2088	2349
2620	262	524	786	1048	1310	1572	1834	2096	2358
2630	263	[illegible]	789	1052	1315	1578	1841	2104	2367
2640	264	[illegible]	792	1056	1320	1584	1848	2112	2376
2650	265	530	795	1060	1325	1590	1855	2120	2385
2660	266	[illegible]	[illegible]	[illegible]	1330	1596	1862	2128	2394
2670	267	534	801	[illegible]	1335	1602	1869	2136	2403
2680	268	536	804	1072	1340	1608	1876	2144	2412
2690	269	538	[illegible]	1076	1345	1614	1883	2152	2421
2700	270	540	810	1080	1350	1620	1890	2160	2430
2710	271	542	813	1084	1355	1626	1897	2168	2439
2720	272	544	816	1088	1360	1632	1904	2176	2448
2730	273	546	819	1092	1365	1638	1911	2184	2457

Diff.	1	2	3	4	5	6	7	8	9
2740	274	548	822	1096	1370	1644	1928	2192	2466
2750	275	550	825	1100	1375	1650	1935	2200	2475
2760	276	552	828	1104	1380	1656	1942	2208	2484
2770	277	554	831	1108	1385	1662	1949	2216	2493
2780	278	556	834	1112	1390	1668	1956	2224	2502
2790	279	558	837	1116	1395	1674	1963	2232	2511
2800	280	560	840	1120	1400	1680	1970	2240	2520
2810	281	562	843	1124	1405	1686	1977	2248	2529
2820	282	564	846	1128	1410	1692	1984	2256	2538
2830	283	566	849	1132	1415	1698	1991	2264	2547
2840	284	568	852	1136	1420	1704	1998	2272	2556
2850	285	570	855	1140	1425	1710	2005	2280	2565
2860	286	572	858	1144	1430	1716	2012	2288	2574
2870	287	574	861	1148	1435	1722	2019	2296	2583
2880	288	576	864	1152	1440	1728	2026	2304	2592
2890	289	578	867	1156	1445	1734	2033	2312	2601
2900	290	580	870	1160	1450	1740	2040	2320	2610
2910	291	582	873	1164	1455	1746	2047	2328	2619
2920	292	584	876	1168	1460	1752	2054	2336	2628
2930	293	586	879	1172	1465	1758	2061	2344	2637
2940	294	588	882	1176	1470	1764	2068	2352	2646
2950	295	590	885	1180	1475	1770	2075	2360	2655
2960	296	592	888	1184	1480	1776	2072	2368	2664
2970	297	594	891	1188	1485	1782	2079	2376	2673
2980	298	596	894	1192	1490	1788	2086	2384	2682
2990	299	598	897	1196	1495	1794	2093	2392	2691
3000	300	600	900	1200	1500	1800	2100	2400	2700
3010	301	602	903	1204	1505	1806	2107	2408	2709
3020	302	604	906	1208	1510	1812	2114	2416	2718
3030	303	606	909	1212	1515	1818	2121	2424	2727
3040	304	608	912	1216	1520	1824	2128	2432	2736
3050	305	610	915	1220	1525	1830	2135	2440	2745
3060	306	612	918	1224	1530	1836	2142	2448	2754
3070	307	614	921	1228	1535	1842	2149	2456	2763
3080	308	616	924	1232	1540	1848	2156	2464	2772
3090	309	618	927	1236	1545	1854	2163	2472	2781
3100	310	620	930	1240	1550	1860	2170	2480	2790
3110	311	622	933	1244	1555	1866	2177	2488	2799
3120	312	624	936	1248	1560	1872	2184	2496	2808
3130	313	626	939	1252	1565	1878	2191	2504	2817
3140	314	628	942	1256	1570	1884	2198	2512	2826
3150	315	630	945	1260	1575	1890	2205	2520	2835

Diff.	1	2	3	4	5	6	7	8	9
3160	316	632	948	1264	1580	1896	2212	2528	2844
3170	317	634	951	1268	1585	1902	2219	2536	2853
3180	318	636	954	1272	1590	1908	2226	2544	2862
3190	319	638	957	1276	1595	1914	2233	2552	2871
3200	320	640	960	1280	1600	1920	2240	2560	2880
3210	321	642	963	1284	1605	1926	2247	2568	2889
3220	322	644	966	1288	1610	1932	2254	2576	2898
3230	323	646	969	1292	1615	1938	2261	2584	2907
3240	324	648	972	1296	1620	1944	2268	2592	2916
3250	325	650	975	1300	1625	1950	2275	2600	2925
3260	326	652	978	1304	1630	1956	2282	2608	2934
3270	327	654	981	1308	1635	1962	2289	2616	2943
3280	328	656	984	1312	1640	1968	2296	2624	2952
3290	329	658	987	1316	1645	1974	2303	2632	2961
3300	330	660	990	1320	1650	1980	2310	2640	2970
3310	331	662	993	1324	1655	1986	2317	2648	2979
3320	332	664	996	1328	1660	1992	2324	2656	2988
3330	333	666	999	1332	1665	1998	2331	2664	2997
3340	334	668	1002	1336	1670	2004	2338	2672	3006
3350	335	670	1005	1340	1675	2010	2345	2680	3015
3360	336	672	1008	1344	1680	2016	2352	2688	3024
3370	337	674	1011	1348	1685	2022	2359	2696	3033
3380	338	676	1014	1352	1690	2028	2366	2704	3042
3390	339	678	1017	1356	1695	2034	2373	2712	3051
3400	340	680	1020	1360	1700	2040	2380	2720	3060
3410	341	682	1023	1364	1705	2046	2387	2728	3069
3420	342	684	1026	1368	1710	2052	2394	2736	3078
3430	343	686	1029	1372	1715	2058	2401	2744	3087
3440	344	688	1032	1376	1720	2064	2408	2752	3096
3450	345	690	1035	1380	1725	2070	2415	2760	3105
3460	346	692	1038	1384	1730	2076	2422	2768	3114
3470	347	694	1041	1388	1735	2082	2429	2776	3123
3480	348	696	1044	1392	1740	2088	2436	2784	3132
3490	349	698	1047	1396	1745	2094	2443	2792	3141
3500	350	700	1050	1400	1750	2100	2450	2800	3150
3510	351	702	1053	1404	1755	2106	2457	2808	3159
3520	352	704	1056	1408	1760	2112	2464	2816	3168
3530	353	706	1059	1412	1765	2118	2471	2824	3177
3540	354	708	1062	1416	1770	2124	2478	2832	3186
3550	355	710	1065	1420	1775	2130	2485	2840	3195
3560	356	712	1068	1424	1780	2136	2492	2848	3204
3570	357	714	1071	1428	1785	2142	2499	2856	3213

Diff.	1	2	3	4	5	6	7	8	9
3580	358	716	1074	1432	1790	2148	2506	2864	3222
3590	359	718	1077	1436	1795	2154	2513	2872	3231
3600	360	720	1080	1440	1800	2160	2520	2880	3240
3610	361	722	1083	1444	1805	2166	2527	2888	3249
3620	362	724	1086	1448	1810	2172	2534	2896	3258
3630	363	726	1089	1452	1815	2178	2541	2904	3267
3640	364	728	1092	1456	1820	2184	2548	2912	3276
3650	365	730	1095	1460	1825	2190	2555	2920	3285
3660	366	732	1098	1464	1830	2196	2562	2928	3294
3670	367	734	1101	1468	1835	2202	2569	2936	3303
3680	368	736	1104	1472	1840	2208	2576	2944	3312
3690	369	738	1107	1476	1845	2214	2583	2952	3321
3700	370	740	1110	1480	1850	2220	2590	2960	3330
3710	371	742	1113	1484	1855	2226	2597	2968	3339
3720	372	744	1116	1488	1860	2232	2604	2976	3348
3730	373	746	1119	1492	1865	2238	2611	2984	3357
3740	374	748	1122	1496	1870	2244	2618	2992	3366
3750	375	750	1125	1500	1875	2250	2625	3000	3375
3760	376	752	1128	1504	1880	2256	2632	3008	3384
3770	377	754	1131	1508	1885	2262	2639	3016	3393
3780	378	756	1134	1512	1890	2268	2646	3024	3402
3790	379	758	1137	1516	1895	2274	2653	3032	3411
3800	380	760	1140	1520	1900	2280	2660	3040	3420
3810	381	762	1143	1524	1905	2286	2667	3048	3429
3820	382	764	1146	1528	1910	2292	2674	3056	3438
3830	383	766	1149	1532	1915	2298	2681	3064	3447
3840	384	768	1152	1536	1920	2304	2688	3072	3456
3850	385	770	1155	1540	1925	2310	2695	3080	3465
3860	386	772	1158	1544	1930	2316	2702	3088	3474
3870	387	774	1161	1548	1935	2322	2709	3096	3483
3880	388	776	1164	1552	1940	2328	2716	3104	3492
3890	389	778	1167	1556	1945	2334	2723	3112	3501
3900	390	780	1170	1560	1950	2340	2730	3120	3510
3910	391	782	1173	1564	1955	2346	2737	3128	3519
3920	392	784	1176	1568	1960	2352	2744	3136	3528
3930	393	786	1179	1572	1965	2358	2751	3144	3537
3940	394	788	1182	1576	1970	2364	2758	3152	3546
3950	395	790	1185	1580	1975	2370	2765	3160	3555
3960	396	792	1188	1584	1980	2376	2772	3168	3564
3970	397	794	1191	1588	1985	2382	2779	3176	3573
3980	398	796	1194	1592	1990	2388	2786	3184	3582
3990	399	798	1197	1596	1995	2394	2793	3192	3591

Diff.	1	2	3	4	5	6	7	8	9
4000	400	800	1200	1600	2000	2400	2800	3200	3600
4010	401	802	1203	1604	2005	2406	2807	3208	3609
4020	402	804	1206	1608	2010	2412	2814	3216	3618
4030	403	806	1209	1612	2015	2418	2821	3224	3627
4040	404	808	1212	1616	2020	2424	2828	3232	3636
4050	405	810	1215	1620	2025	2430	2835	3240	3645
4060	406	812	1218	1624	2030	2436	2842	3248	3654
4070	407	814	1221	1628	2035	2442	2849	3256	3663
4080	408	816	1224	1632	2040	2448	2856	3264	3672
4090	409	818	1227	1636	2045	2454	2863	3272	3681
4100	410	820	1230	1640	2050	2460	2870	3280	3690
4110	411	822	1233	1644	2055	2466	2877	3288	3699
4120	412	824	1236	1648	2060	2472	2884	3296	3708
4130	413	826	1239	1652	2065	2478	2891	3304	3717
4140	414	828	1242	1656	2070	2484	2898	3312	3726
4150	415	830	1245	1660	2075	2490	2905	3320	3735
4160	416	832	1248	1664	2080	2496	2912	3328	3744
4170	417	834	1251	1668	2085	2502	2919	3336	3753
4180	418	836	1254	1672	2090	2508	2926	3344	3762
4190	419	838	1257	1676	2095	2514	2933	3352	3771
4200	420	840	1260	1680	2100	2520	2940	3360	3780
4210	421	842	1263	1684	2105	2526	2947	3368	3789
4220	422	844	1266	1688	2110	2532	2954	3376	3798
4230	423	846	1269	1692	2115	2538	2961	3384	3807
4240	424	848	1272	1696	2120	2544	2968	3392	3816
4250	425	850	1275	1700	2125	2550	2975	3400	3825
4260	426	852	1278	1704	2130	2556	2982	3408	3834
4270	427	854	1281	1708	2135	2562	2989	3416	3843
4280	428	856	1284	1712	2140	2568	2996	3424	3852
4290	429	858	1287	1716	2145	2574	3003	3432	3861
4300	430	860	1290	1720	2150	2580	3010	3440	3870
4310	431	862	1293	1724	2155	2586	3017	3448	3879
4320	432	864	1296	1728	2160	2592	3024	3456	3888

The End of the Table of PROPORTIONAL PARTS.

A
TABLE
OF
Natural and Artificial *Sines*, *Tangents*, and *Secants*, to every Degree and Minute of the

QUADRANT,

The *Radius* of the Artificial being 10,0000000, and of the Natural 10,000,000.

o DEGREES.

N	Sine.	Co-Sine.	Tangent.	Co-Tang.	Secant.	Co-Secant.	
0	0	10000000	0	Infinit.	10000000	Infinit.	60
1	2909	9999999	2909	343774667	10000000	343774682	59
2	5818	9999998	5818	171887319	10000002	171887348	58
3	8727	9999996	8727	114591530	10000004	114591574	57
4	11636	9999993	11636	85943630	10000007	85943689	56
5	14544	9999989	14544	68754887	10000011	68754960	55
6	17453	9999989	17453	57295721	10000016	57295809	54
7	20362	9999979	20362	49110600	10000021	49110702	53
8	23271	9999973	23271	42971757	10000027	42971873	52
9	26180	9999966	26180	38197099	10000034	38197230	51
10	29089	9999958	29089	34377371	10000042	34377516	50
11	31998	9999949	31998	31252137	10000051	31252297	49
12	34906	9999939	34907	28647773	10000061	28647948	48
13	37815	9999928	37816	26444080	10000072	26444269	47
14	40724	9999917	40725	24555198	10000083	24555402	46
15	43633	9999905	43633	22918166	10000095	22918385	45
16	46542	9999892	46542	21485762	10000108	21485995	44
17	49451	9999878	49451	20221875	10000122	20222122	43
18	52360	9999863	52360	19098419	10000137	19098680	42
19	55268	9999847	55269	18093220	10000153	18093496	41
20	58177	9999831	58178	17188540	10000170	17188831	40
21	61086	9999813	61087	16370019	10000187	16370325	39
22	63995	9999795	63996	15625908	10000205	15626228	38
23	66904	9999776	66905	14946502	10000224	14946837	37
24	69813	9999756	69814	14323712	10000244	14324061	36
25	72721	9999736	72723	13750745	10000265	13751108	35
26	75630	9999714	75632	13221851	10000286	13222229	34
27	78539	9999692	78541	12732134	10000308	12732526	33
28	81448	9999669	81450	12277396	10000331	12277803	32
29	84357	9999644	84360	11854018	10000355	11854440	31
30	87265	9999619	87269	11458865	10000380	11459301	30
	Co-Sine.	Sine.	Co-Tang.	Tangent.	Co-Secant.	Secant.	N

89 DEGREES.

Latitude 00 Deg. 00 Min. North Declination.

N S	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
			h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
			12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	Zenith West.		00.1	1	00.2	2	00.4	2	00.6	2	00.8	1	00.9	2	0.11	2	0.13	2	0.15	2	0.17	2	0.19		.20
2			00.3	3	00.6	3	00.9	4	0.13	4	0.17	3	0.20	3	0.23	4	0.27	4	0.31	4	0.35	4	0.39		0.42
3			00.5	5	0.10	5	0.15	6	0.21	6	0.27	5	0.32	6	0.38	6	0.44	6	0.50	6	0.56	7	1.03		1.08
4			00.8	8	0.16	8	0.24	8	0.32	9	0.41	8	0.49	9	0.58	9	1.07	9	1.16	9	1.25	10	1.35		1.43
5			0.13	13	0.26	14	0.40	14	0.54	14	1.08	[illegible]	1.20	13	[illegible]	13	1.46	[illegible]	[illegible]	13	2.12	13	[illegible]	[illegible]	2.43
6			0.20	20	0.40	20	1.00	20	1.20	21	1.41	29	2.10	29	2.39	29	3.08	29	3.37	29	4.06	1	[illegible]		
7			0.50	50	1.40	50	2.30	50	3.20	50	4.10														

o DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	0	10.0000000	0	Infinit.	10.0000000	Infinit.	60
1	6.4637261	9.9999999	6.4637261	13.5362739	10.0000000	13.5362739	59
2	6.7647561	9.9999999	6.7647562	13.2352438	10.0000001	13.2352439	58
3	6.9408473	9.9999998	6.9408475	13.0591525	10.0000002	13.0591527	57
4	7.0657860	9.9999997	7.0657863	12.9342137	10.0000003	12.9342140	56
5	7.1626960	9.9999995	7.1626964	12.8373036	10.0000005	12.8373040	55
6	7.2418771	9.9999993	7.2418778	12.7581222	10.0000007	12.7581229	54
7	7.3088239	9.9999991	7.3088248	12.6911752	10.0000009	12.6911761	53
8	7.3668157	9.9999988	7.3668169	12.6331831	10.0000012	12.6331843	52
9	7.4179681	9.9999985	7.4179696	12.5820304	10.0000015	12.5820319	51
10	7.4637255	9.9999982	7.4637273	12.5362727	10.0000018	12.5362745	50
11	7.5051181	9.9999978	7.5051203	12.4948797	10.0000022	12.4948819	49
12	7.5429065	9.9999974	7.5429091	12.4570909	10.0000026	12.4570935	48
13	7.5776684	9.9999969	7.5776715	12.4223285	10.0000031	12.4223316	47
14	7.6098530	9.9999964	7.6098565	12.3901434	10.0000036	12.3901470	46
15	7.6398160	9.9999959	7.6398201	12.3601799	10.0000041	12.3601840	45
16	7.6678445	9.9999953	7.6678492	12.3321508	10.0000047	12.3321555	44
17	7.6941733	9.9999947	7.6941786	12.3058214	10.0000053	12.3058267	43
18	7.7189966	9.9999940	7.7190026	12.2809974	10.0000060	12.2810034	42
19	7.7424775	9.9999934	7.7424841	12.2575159	10.0000066	12.2575225	41
20	7.7647537	9 9999927	7.7647610	12.2352390	10.0000073	12.2352463	40
21	7.7859427	9.9999919	7.7859508	12.2140492	10.0000081	12.2140573	39
22	7.8061458	9.9999911	7.8061547	12.1938453	10.0000089	12.1938542	38
23	7.8254507	9.9999903	7.8254604	12.1745396	10.0000097	12.1745493	37
24	7.8439338	9.9999894	7.8439444	12.1560556	10.0000106	12.1560662	36
25	7.8616623	9.9999885	7.8616738	12.1383262	10.0000115	12.1383377	35
26	7.8786953	9.9999876	7.8787077	12.1212923	10.0000124	12.1213047	34
27	7.8950854	9.9999866	7.8950988	12.1049012	10.0000134	12.1049146	33
28	7.9108793	9.9999856	7.9108938	12.0891062	10.0000144	12.0891207	32
29	7.9261190	9.9999845	7.9261344	12.0738656	10.0000155	12.0738810	31
30	7.9408419	9.9999835	7.9408584	12.0591416	10.0000165	12.0591581	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

89 DEGREES.

Latitude 00 Deg. 00 Min. South Declination.

S N	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
		m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
			12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	Zenith West.		00.1	1	00.2	2	00.4	2	00.6	2	00.8	1	00.9	2	0.11	2	0.13	2	0.15	2	0.17	2	0.19	1	0.20
2			00.3	3	00.6	3	00.9	4	0.13	4	0.17	3	0'20	3	0.23	4	0.27	4	0.31	4	0.35	4	0.39	3	0.42
3			00.5	5	0.10	5	0.15	6	0.21	6	0.27	5	0.32	6	0.38	6	0.44	6	0.50	6	0.56	7	1.03	5	1.08
4			00.8	8	0.16	8	0.24	8	0.32	9	0.41	8	0.49	9	0.58	9	1.07	9	1.16	9	1.25	10	1.35	8	1.43
5			0.12	12	0.24	12	0.36	12	0.48	13	1.01	14	1.13	14	1.29	14	1.43	14	1.57	15	2.12	13	2.25	19	2.44
6			0.20	20	0.40	20	1.00	20	1.20	21	1.41	29	2.10	29	2.39	29	3.08	29	3.37	29	4.06	61	5.07		
7			0.50	50	1.40	50	2.30	50	3.20	50	4.10														

0 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	87265	9999619	87269	11458865	10000380	11459301	30
31	90174	9999593	90178	11089205	10000406	11089656	29
32	93083	9999566	93087	10742648	10000433	10743114	28
33	95992	9999539	95996	10417094	10000461	10417574	27
34	98900	9999511	98905	10110690	10000489	10111185	26
35	101809	9999482	101814	98217943	10000518	98223033	25
36	104718	9999452	104724	95489475	10000548	95494711	24
37	107627	9999421	107633	92908487	10000579	92913869	23
38	110535	9999389	110542	90463336	10000611	90468863	22
39	113444	9999356	113451	88143572	10000644	88149244	21
40	116353	9999323	116361	85939791	10000677	85945609	20
41	119261	9999289	119270	83843507	10000711	83849470	19
42	122170	9999254	122179	81847041	10000746	81853150	18
43	125079	9999218	125088	79943430	10000782	79949684	17
44	127987	9999181	127996	78126342	10000819	78132742	16
45	130896	9999143	130907	76390009	10000857	76396554	15
46	133805	9999104	133817	74729165	10000896	74735856	14
47	136713	9999065	136726	73138991	10000935	73145827	13
48	139622	9999025	139635	71615070	10000975	71622052	12
49	142530	9998984	142545	70153346	10001016	70160474	11
50	145439	9998942	145454	68750087	10001058	68757360	10
51	148348	9998899	148364	67401854	10001101	67409272	9
52	151256	9998855	151273	66105473	10001145	66113036	8
53	154165	9998811	154183	64858008	10001189	64865716	7
54	157073	9998766	157093	63656741	10001234	63664595	6
55	159982	9998720	160002	62499154	10001280	62507153	5
56	162890	9998673	162912	61382905	10001327	61391050	4
57	165799	9998625	165821	60305820	10001375	60314110	3
58	168707	9998576	168731	59265872	10001424	59274308	2
59	171616	9998527	171641	58261174	10001473	58269755	1
60	174524	9998477	174551	57289962	10001523	57298689	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co Secant.	N. Secant.	M

89 DEGREES.

Latitude 1 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d	8	d	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
N S			12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1			00.1	1	00.2	2	00.3	2	00.5	2	00.7	1	00.8	2	0.10	2	0.12	2	0.14	2	0.16	2	0.18	1	0.19
2			00.2	3	00.5	3	00.8	3	0.11	3	0.14	3	0.17	4	0.21	4	0.25	4	0.29	4	0.33	4	0.37	3	0.40
3			00.4	5	00.9	5	0.14	5	0.19	5	0.24	5	0.29	6	0.35	6	0.41	6	0.47	6	0.53	7	1.00	5	1.05
4			00.7	7	0.14	7	0.21	8	0.29	8	0.37	8	0.45	9	0.54	9	1.03	9	1.12	9	1.21	10	1.31	8	1.39
5			0.11	11	0.22	11	0.33	11	0.44	12	0.56	14	1.10	14	1.24	14	1.38	15	1.52	14	2.06	17	2.23	14	2.37
6			0.19	19	0.38	19	0.57	19	1.16	19	1.35	27	2.02	27	2.29	28	2.57	28	3.25	28	3.53	1.7	5.00		
7			0.45	45	1.20	46	2.06	46	3.02	46	3.48														

0 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	7.9408419	9.9999835	7.9408584	12.0591416	10.0000165	12.0591581	30
31	7.9550819	9.9999823	7.9550996	12.0449004	10.0000177	12.0449181	29
32	7.9688698	9.9999812	7.9688886	12.0311114	10.0000188	12.0311302	28
33	7.9822334	9.9999800	7.9822534	12.0177466	10.0000200	12.0177666	27
34	7.9951980	9.9999788	7.9952192	12.0047808	10.0000212	12.0048020	26
35	8.0077867	9.9999775	8.0078092	11.9921908	10.0000225	11.9922133	25
36	8.0200207	9.9999762	8.0200445	11.9799555	10.0000238	11.9799793	24
37	8.0319195	9.9999748	8.0319446	11.9680554	10.0000252	11.9680805	23
38	8.0435009	9.9999735	8.0435274	11.9564726	10.0000265	11.9564991	22
39	8.0547814	9.9999721	8.0548094	11.9451906	10.0000279	11.9452186	21
40	8.0657763	9.9999706	8.0658057	11.9341943	10.0000294	11.9342237	20
41	8.0764997	9.9999691	8.0765306	11.9234694	10.0000309	11.9235[illegible]3	19
42	8.0869646	9.9999676	8.0869970	11.9130030	10.0000324	11.913[illegible]354	18
43	8.0971832	9.9999660	8.0972172	11.9027828	10.0000340	11.9028168	17
44	8.1071669	9.9999644	8.1072025	11.8927975	10.0000356	11.8928331	16
45	8.1169262	9.9999628	8.1169634	11.8830366	10.0000372	11.88[illegible]738	15
46	8.1264710	9.9999611	8.1265099	11.8734901	10.0000389	11.87[illegible]29[illegible]	14
47	8.1358104	9.9999594	8.1358510	11.8641490	10.0000406	11.8641896	13
48	8.1449532	9.9999577	8.1449956	11.8550044	10.0000423	11.8550468	12
49	8.1539075	9.9999559	8.1539516	11.8460484	10.0000441	11.8460925	11
50	8.1626808	9.9999541	8.1627267	11.8372733	10.0000459	11.8373192	10
51	8.1712804	9.9999522	8.1713282	11.8286718	10.0000478	11.8287196	9
52	8.1797129	9.9999503	8.1797626	11.8202374	10.0000497	11.82[illegible]2871	8
53	8.1879848	9.9999484	8.1880364	11.8119636	10.0000516	11.8120152	7
54	8.1961020	9.9999464	8.1961556	11.8038444	10.0000536	[illegible]	6
55	8.2040703	9.9999444	8.2041259	11.7958741	10.0000556	11.7959297	5
56	8.2118949	9.9999424	8.2119526	11.7880474	10.0000576	11.7881051	4
57	8.2195811	9.9999403	8.2196408	11.7803592	10.0000597	11.7804189	3
58	8.2271335	9.9999382	8.2271953	11.7728047	10.0000618	11.7728665	2
59	8.2345568	9.9999360	8.2346208	11.7653792	10.0000640	11.7654432	1
60	8.2418553	9.9999338	8.2419215	11.7580785	10.0000662	11.7581447	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

89 DEGREES.

Latitude 1 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23
	h. m.	m	h. m.	m.	h. m.	m	h. m.	m	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m	h. m	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.1	1	00.2	1	00.3	2	00.5	2	00.7	2	00.9	1	0.10	1	0.11	2	0.13	2	0.15	2	0.17	2	0.19	2	0.21
2	00.2	3	00.5	3	00.8	3	0.11	3	0.14	4	0.18	3	0.21	4	0.25	4	0.29	4	0.33	4	0.37	3	0.41	3	0.43
3	00.3	5	00.8	5	0.13	5	0.18	6	0.24	6	0.30	5	0.35	6	0.41	6	0.47	6	0.53	6	0.59	6	1.05	5	1.10
4	00.4	8	0.12	8	0.20	8	0.28	8	0.36	9	0.45	8	0.53	9	1.02	9	1.11	9	1.20	9	1.29	10	1.39	8	1.47
5	00.6	12	0.18	12	0.30	12	0.52	13	1.05	13	1.08	14	1.22	14	1.36	14	1.50	14	2.04	14	2.18	17	2.35	14	2.49
6	0.10	20	0.30	20	0.50	20	1.10	20	1.30	21	1.51	29	2.20	29	2.49	29	3.10	29	3.47	29	4.16	1.3	5.19		
7	0.20	49	1.09	49	2.08	50	3.58	50	4.48	50	4.28														

I DEGREE.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	174524	9998477	174551	57289962	10001523	57298688	60
1	177432	9998426	177460	56350590	10001574	56359462	59
2	180341	9998374	180370	55441517	10001626	55450534	58
3	183249	9998321	183280	54561300	10001679	54570463	57
4	186158	9998267	186190	53708587	10001733	53717896	56
5	189066	9998212	189100	52882109	10001788	52891564	55
6	191974	9998157	192010	52080673	10001843	52090272	54
7	194883	9998101	194920	51303157	10001899	51312902	53
8	197791	9998044	197830	50548506	10001956	50558396	52
9	200699	9997986	200740	49815726	10002014	49825762	51
10	203608	9997927	203650	49103881	10002073	49114062	50
11	206516	9997867	206560	48412084	10002133	48422411	49
12	209424	9997806	209470	47739501	10002194	47749974	48
13	212332	9997745	212380	47085343	10002255	47095961	47
14	215241	9997683	215291	46448862	10002317	46459625	46
15	218149	9997620	218201	45829351	10002380	45840260	45
16	221057	9997556	221111	45226141	10002444	45237195	44
17	223965	9997491	224021	44638596	10002509	44649795	43
18	226873	9997425	226932	44066113	10002575	44077458	42
19	229781	9997359	229842	43508122	10002641	43519612	41
20	232690	9997292	232753	42964077	10002708	42975713	40
21	235598	9997224	235663	42433464	10002776	42445245	39
22	238506	9997155	238574	41915790	10002845	41927717	38
23	241414	9997085	241484	41410588	10002915	41422660	37
24	244322	9997014	244395	40917412	10002986	40929629	36
25	247230	9996943	247305	40435837	10003058	40448201	35
26	250138	9996871	250216	39965460	10003130	39977969	34
27	253046	9996798	253127	39505895	10003203	39518549	33
28	255954	9996724	256038	39056771	10003277	39069571	32
29	258862	9996649	258948	38617738	10003352	38630683	31
30	261769	9996573	261859	38188459	10003428	38201550	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

88 DEGREES.

Latitude 2 Deg. 00 Min. *North Declination.*

	0	d.	2	d	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.		h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.
S N	12.0	n s	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.2	1			00.1	2	00.3	2	00.5	2	00.7	1	00.8	1	00.9	2	0.11	2	0.13	2	0.15	2	0.17	1	0.18
2	00.4	2			00.2	3	00.5	4	00.9	4	0.13	3	0.16	4	0.20	4	0.24	4	0.28	4	0.32	4	0.36	2	0.38
3	00.5	3			00.3	6	00.9	6	0.15	7	0.22	5	0.27	6	0.33	6	0.39	6	0.45	6	0.51	6	0.57	4	1.01
4	00.8	4			00.5	9	0.14	9	0.23	10	0.33	8	0.41	9	0.50	9	0.59	9	1.08	9	1.17	10	1.27	8	1.35
5	0.12	5			00.8	13	0.21	14	0.35	14	0.49	14	1.03	14	1.17	14	1.31	14	1.45	15	2.00	16	2.16	14	2.30
6	0.16	6			0.14	22	0.36	22	0.58	23	1.21	28	1.49	29	2.18	29	2.47	29	3.16	29	3.45	1.1	4.46		
7	0.40	7			0.27	58	1.25	59	2.24	59	3.23														
N E	6.00																								

I DEGREE.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	8.2418553	9.9999338	8.2419215	11.7580785	10.0000661	11.7581447	60
1	8.2490332	9.9999316	8.2491015	11.7508985	10.0000684	11.7509668	59
2	8.2560943	9.9999294	8.2561649	11.7438351	10.0000706	11.7439057	58
3	8.2630424	9.9999271	8.2631153	11.7368847	10.0000729	11.7369576	57
4	8.2698810	9.9999247	8.2699563	11.7300437	10.0000753	11.7301890	56
5	8.2766136	9.9999224	8.2766912	11.7233088	10.0000776	11.7233864	55
6	8.2832434	9.9999200	8.2833234	11.7166766	10.0000800	11.7167566	54
7	8.2897734	9.9999175	8.2898559	11.7101441	10.0000825	11.7102266	53
8	8.2962067	9.9999150	8.2962917	11.7037083	10.0000850	11.7037933	52
9	8.3025460	9.9999125	8.3026335	11.6973665	10.0000875	11.6974540	51
10	8.3087941	9.9999100	8.3088842	11.6911158	10.0000900	11.6912059	50
11	8.3149536	9.9999074	8.3150462	11.6849538	10.0000926	11.6850464	49
12	8.3210269	9.9999047	8.3211221	11.6788779	10.0000953	11.6789731	48
13	8.3270163	9.9998021	8.3271143	11.6728857	10.0000979	11.6729837	47
14	8.3329243	9.9998994	8.3330249	11.6669751	10.0001006	11.6670757	46
15	8.3387529	9.9998966	8.3388563	11.6611437	10.0001034	11.6612471	45
16	8.3445043	9.9998939	8.3446105	11.6553895	10.0001061	11.6554957	44
17	8.3501805	9.9998911	8.3502895	11.6497105	10.0001089	11.6498195	43
18	8.3557835	9.9998882	8.3558953	11.6441047	10.0001118	11.6442165	42
19	8.3613150	9.9998853	8.3614297	11.6385703	10.0001147	11.6386850	41
20	8.3667769	9.9998824	8.3668945	11.6331055	10.0001176	11.6332231	40
21	8.3721710	9.9998794	8.3722915	11.6277085	10.0001206	11.6278290	39
22	8.3774988	9.9998764	8.3776223	11.6223777	10.0001236	11.6225012	38
23	8.3827620	9.9998734	8.3828886	11.6171114	10.0001266	11.6172380	37
24	8.3879622	9.9998703	8.3880918	11.6119082	10.0001297	11.6120378	36
25	8.3931008	9.9998672	8.3932336	11.6067664	10.0001328	11.6068992	35
26	8.3981793	9.9998641	8.3983152	11.6016848	10.0001359	11.6018207	34
27	8.4031990	9.9998609	8.4033381	11.5966619	10.0001391	11.5968010	33
28	8.4081614	9.9998577	8.4083037	11.5916963	10.0001423	11.5918386	32
29	8.4130676	9.9998544	8.4132132	11.5867868	10.0001456	11.5869324	31
30	8.4179190	9.9998512	8.4180679	11.5819321	10.0001488	11.5820810	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

88 DEGREES.

Latitude 2 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d	18	d.	20	d	22	d	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.2	1	00.3	1	00.4	2	00.6	2	00.8	2	0.10	1	0.11	1	0.12	2	0.14	2	0.16	2	0.18	2	0.20	2	0.22
2	00.3	3	00.6	3	00.9	3	0.12	4	0.16	4	0.20	3	0.23	3	0.26	4	0.30	4	0.34	4	0.38	4	0.42	3	0.45
3	00.5	5	0.10	5	0.15	5	0.20	6	0.26	6	0.32	5	0.37	6	0.43	6	0.49	6	0.55	6	1.01	7	1.08	3	1.11
4	00.8	8	0.16	8	0.24	8	0.32	8	0.40	9	0.49	8	0.57	9	1.06	9	1.15	9	1.24	9	1.33	10	1.43	8	1.51
5	0.12	12	0.24	12	0.36	12	0.48	12	1.00	13	1.13	14	1.27	14	1.41	14	1.55	14	2.09	14	2.23	17	2.40	14	2.54
6	0.16	20	0.36	21	0.57	21	1.18	21	1.39	21	2.00	28	2.28	29	2.57	29	3.26	29	3.55	29	4.24	1.0	5.24		
7	0.40	48	1.28	48	2.16	49	3.05	49	3.54	49	4.43														

I DEGREE.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	261769	9996573	261859	38188459	10003428	38201550	30
31	264677	9996496	264770	37769613	10003505	37781849	29
32	217585	9996419	267681	37357892	10003582	37371273	28
33	270493	9996341	270592	36956001	10003660	36969528	27
34	273401	9996262	273503	36562659	10003739	36576332	26
35	276309	9996182	276414	36177596	10003819	36191414	25
36	279216	9996101	279325	35800553	10003900	35814517	24
37	282124	9996019	282236	35431282	10003982	35445391	23
38	285032	9995936	285148	35069546	10004065	35083800	22
39	287940	9995853	288059	34715115	10004148	34729515	21
40	290847	9995769	290970	34367771	10004232	34382316	20
41	293755	9995684	293882	34027303	10004317	34041994	19
42	296662	9995598	296793	33693509	10004403	33708345	18
43	299570	9995511	299705	33366194	10004490	33381176	17
44	302478	9995424	302616	33045173	10004578	33060300	16
45	305385	9995336	305528	32730264	10004667	32745536	15
46	308293	9995247	308439	32421295	10004756	32436713	14
47	311200	9995157	311351	32118099	10004846	32133663	13
48	314108	9995066	314263	31820516	10004937	31836225	12
49	317015	9994974	317174	31528392	10005029	31544246	11
50	319922	9994881	320086	31241577	10005122	31257577	10
51	322830	9994788	322998	30959928	10005215	30976074	9
52	325737	9994694	325910	30683307	10005309	30699598	8
53	328644	9994599	328822	30411580	10005405	30428017	7
54	331552	9994503	331734	30144619	10005501	30161201	6
55	334459	9994406	334645	29882299	10005598	29899026	5
56	337366	9994308	337558	29624499	10005696	29641373	4
57	340273	9994209	340471	29371106	10005795	29388124	3
58	343181	9994109	343383	29122005	10005894	29139169	2
59	346088	9994009	346295	28877089	10005994	28894398	1
60	348995	9993908	349208	28636253	10006095	28653708	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

88 DEGREES.

Latitude 3 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.		h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m	h. m.	m.	h. m	m	h. m	m.	h. m.
S N	12.0	n s	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.2	1			00.1	1	00.2	2	00.4	2	00.6	1	00.7	1	00.8	2	0.10	2	0.12	2	0.14	2	0.16	2	0.18
2	00.5	2			00.2	3	00.5	3	00.8	4	0.12	3	0.15	3	0.18	4	0.22	4	0.26	4	0.30	4	0.34	3	0.37
3	00.8	3			00.3	5	00.8	5	0.13	6	0.19	5	0.24	6	0.30	6	0.36	6	0.42	6	0.48	6	0.54	5	0.59
4	0.12	4			00.5	8	0.13	8	0.21	8	0.29	8	0.37	9	0.46	9	0.55	9	1.04	9	1.13	10	1.23	6	1.31
5	0.18	5			00.8	11	0.19	12	0.31	12	0.43	14	0.57	14	1.11	14	1.25	14	1.39	15	1.54	16	2.10	14	2.24
6	0.29	6			0.12	19	0.31	20	0.51	20	1.11	28	1.39	28	2.07	28	2.35	29	3.04	29	3.33	58	4.31		
7	0.59	7			0.16	53	1.09	54	2.03	54	2.57														
N E	6.00																								

I DEGREE.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	8.4179199	9.9998512	8.4180679	11.5819321	10.0001488	11.5820810	30
31	8.4227168	9.9998478	8.4228690	11.5771310	10.0001522	11.5772832	29
32	8.4274621	9.9998445	8.4276176	11.5723824	10.0001555	11.5725379	28
33	8.4321561	9.9998411	8.4323150	11.5676850	10.0001589	11.5678439	27
34	8.4367999	9.9998376	8.4369622	11.5630378	10.0001624	11.5632001	26
35	8.4413949	9.9998342	8.4415603	11.5584397	10.0001658	11.5586056	25
36	8.4459409	9.9998306	8.4461103	11.5538897	10.0001694	11.5540591	24
37	8.4504402	9.9998271	8.4506131	11.5493869	10.0001729	11.5495598	23
38	8.4548934	9.9998235	8.4550699	11.5449301	10.0001765	11.5451066	22
39	8.4593013	9.9998199	8.4594814	11.5405186	10.0001801	11.5406987	21
40	8.4636649	9.9998162	8.4638486	11.5361514	10.0001838	11.5363351	20
41	8.4679850	9.9998125	8.4681725	11.5318275	10.0001875	11.5320150	19
42	8.4722626	9.9998088	8.4724538	11.5275462	10.0001912	11.5277374	18
43	8.4764984	9.9998050	8.4766933	11.5233067	10.0001950	11.5235016	17
44	8.4806932	9.9998012	8.4808920	11.5191080	10.0001980	11.5193068	16
45	8.4848479	9.9997974	8.4850505	11.5149495	10.0002026	11.5151521	15
46	8.4889632	9.9997935	8.4891696	11.5108304	10.0002065	11.5110368	14
47	8.4930398	9.9997896	8.4932502	11.5067498	10.0002104	11.5069602	13
48	8.4970784	9.9997856	8.4972928	11.5027072	10.0002144	11.5029216	12
49	8.5010798	9.9997817	8.5012982	11.4987018	10.0002183	11.4989202	11
50	8.5050447	9.9997776	8.5052672	11.4947329	10.0002224	11.4949553	10
51	8.5089736	9.9997736	8.5092001	11.4907999	10.0002264	11.4910264	9
52	8.5128673	9.9997695	8.5130978	11.4869022	10.0002305	11.4871327	8
53	8.5167264	9.9997653	8.5169610	11.4830387	10.0002347	11.4832736	7
54	8.5205514	9.9997612	8.5207902	11.4792098	10.0002388	11.4794486	6
55	8.5243430	9.9997570	8.5245860	11.4754140	10.0002430	11.4756570	5
56	8.5281017	9.9997527	8.5283490	11.4716510	10.0002473	11.4718983	4
57	8.5318281	9.9997484	8.5320797	11.4679203	10.0002516	11.4681719	3
58	8.5355228	9.9997441	8.5357787	11.4642213	10.0002559	11.4644772	2
59	8.5391863	9.9997398	8.5394465	11.4605534	10.0002602	11.4608137	1
60	8.5428192	9.9997354	8.5430838	11.4569162	10.0002646	11.4571808	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

88 DEGREES.

Latitude 3 Deg. 00 Min. *South Declination.*

	0	d.	2	d	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.2	1	00.3	1	00.4	2	00.6	2	00.8	2	0.10	1	0.11	2	0.13	2	0.15	2	0.17	2	0.19	2	0.21	1	0.22
2	00.5	3	00.8	3	0.11	3	0.14	4	0.18	4	0.22	3	0.25	3	0.28	4	0.32	4	0.36	4	0.40	4	0.44	3	0.47
3	00.8	5	0.13	5	0.18	5	0.22	6	0.28	6	0.35	5	0.40	6	0.46	6	0.52	6	0.58	6	1.04	6	1.10	5	1.15
4	0.12	8	0.20	8	0.28	9	0.37	9	0.46	9	0.53	8	1.01	9	1.10	9	1.19	9	1.28	9	1.37	10	1.47	8	1.55
5	0.18	12	0.30	12	0.42	12	0.54	12	1.06	13	1.19	14	1.33	14	1.47	14	2.01	14	2.15	15	2.30	16	2.46	14	3.00
6	0.29	20	0.49	20	1.09	20	1.29	20	1.49	20	2.09	28	2.37	28	3.05	28	3.33	29	4.02	29	4.31	58	5.29		
7	0.59	47	1.46	47	2.33	47	3.20	47	4.07	48	4.55														

2 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	348995	9993908	349208	28636253	10006095	28653708	60
1	351902	9993806	352120	28399397	10006197	28416997	59
2	354809	9993703	355033	28166422	10006300	28184168	58
3	357716	9993599	357945	27937233	10006404	27955125	57
4	360623	9993495	360858	27711740	10006509	27729777	56
5	363530	9993390	363771	27489853	10006615	27508035	55
6	366437	9993284	3666[illegible]	27271486	10006721	27289814	54
7	369344	9993177	369596	27056557	10006828	27075030	53
8	372251	9993069	372509	26844984	10006936	26863603	52
9	375158	9992960	375422	26636690	10007045	26655455	51
10	378065	9992851	378335	26431600	10007155	26450510	50
11	380971	9992740	381248	26229638	10007266	26248694	49
12	383878	9992629	384161	26030736	10007377	26049937	48
13	386785	9992517	387074	25834823	10007489	25854169	47
14	389691	9992404	389988	25641832	10007602	25661324	46
15	392598	9992290	392901	25451700	10007716	25471337	45
16	395505	9992175	395814	25254361	10007831	25284144	44
17	398411	9992060	398728	25079757	10007947	25099685	43
18	401318	9991944	401641	24897826	10008063	24917900	42
19	404224	9991827	404555	24718512	10008180	24738731	41
20	407131	9991709	407469	24541758	10008298	24562123	40
21	410037	9991590	410383	24367509	10008417	24388020	39
22	412944	9991470	413296	24195714	10008537	24216370	38
23	415850	9991349	416210	24026320	10008658	24047121	37
24	418757	9991228	419124	23859277	10008780	23880224	36
25	421663	9991106	422038	23694537	10008902	23715630	35
26	424569	9990983	424952	23532052	10009025	23553290	34
27	427475	9990859	427866	23371777	10009149	23393161	33
28	430382	9990734	430781	23213666	10009274	23235196	32
29	433288	9990608	433695	23057677	10009400	23079351	31
30	436194	9990482	436609	22903765	10009527	22925586	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

87 DEGREES.

Latitude 4 Deg. 00 Min. *North Declination.*

	2	d.			4	d.	6	d	8	d	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.			h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		N S		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.1		1		00.1	1	00.2	1	00.3	2	00.5	1	00.6	1	0.07	2	0.09	2	0.11	2	0.13	2	0.15	2	0.17
2	00.2		2		00.1	3	00.4	3	00.7	3	0.10	3	0.13	3	0.16	4	0.20	4	0.24	4	0.28	4	0.32	3	0.35
3	00.5		3		00.2	4	00.6	5	0.11	5	0.16	5	0.21	6	0.27	6	0.33	6	0.39	6	0.45	7	0.52	5	0.57
4	00.7		4		00.2	6	00.8	6	0.14	7	0.21	9	0.30	9	0.39	10	0.49	10	0.59	10	1.09	10	1.19	8	1.27
5	0.11		5		00.2	11	0.13	12	0.25	12	0.37	14	0.51	14	1.05	14	1.19	14	1.33	14	1.47	17	2.04	13	2.17
6	0.18		6		00.4	19	0.23	19	0.42	19	1.01	28	1.29	28	1.57	28	2.25	28	2.53	28	3.21	56	4.17		
7	0.35		7		0.10	46	0.56	46	1.42	47	2.29														
NE	3.35																								

2 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	8.5428192	9.9997354	8.5430838	11.4569162	10.0002646	11.4571808	60
1	8.5464218	9.9997309	8.5466909	11.4533091	10.0002691	11.4535782	59
2	8.5499948	9.9997265	8.5502683	11.4497317	10.0002735	11.4500052	58
3	8.5535386	9.9997220	8.5538166	11.4461834	10.0002780	11.4464614	57
4	8.5570536	9.9997174	8.5573362	11.4426638	10.0002826	11.4429464	56
5	8.5605404	9.9997128	8.5608276	11.4391724	10.0002872	11.4394596	55
6	8.5639994	9.9997082	8.5642912	11.4357088	10.0002918	11.4360006	54
7	8.5674310	9.9997036	8.5677275	11.4322725	10.0002964	11.4325690	53
8	8.5708357	9.9996989	8.5711368	11.4288632	10.0003011	11.4291643	52
9	8.5742139	9.9996942	8.5745197	11.4254803	10.0003058	11.4257861	51
10	8.5775660	9.9996894	8.5778766	11.4221234	10.0003106	11.4224340	50
11	8.5808923	9.9996846	8.5812077	11.4187923	10.0003154	11.4191077	49
12	8.5841933	9.9996798	8.5845136	11.4154864	10.0003202	11.4158067	48
13	8.5874694	9.9996749	8.5877945	11.4122055	10.0003251	11.4125306	47
14	8.5907209	9.9996700	8.5910509	11.4089491	10.0003300	11.4092791	46
15	8.5939483	9.9996650	8.5942832	11.4057168	10.0003350	11.4060517	45
16	8.5971517	9.9996601	8.5974917	11.4025083	10.0003399	11.4028483	44
17	8.6003317	9.9996550	8.6006767	11.3993233	10.0003450	11.3996683	43
18	8.6034886	9.9996500	8.6038386	11.3961614	10.0003500	11.3965114	42
19	8.6066226	9.9996449	8.6069777	11.3930223	10.0003551	11.3933774	41
20	8.6097341	9.9996398	8.6100943	11.3899057	10.0003602	11.3902659	40
21	8.6128235	9.9996346	8.6131889	11.3868111	10.0003654	11.3871765	39
22	8.6158910	9.9996264	8.6162616	11.3837384	10.0003706	11.3841090	38
23	8.6189369	9.9996242	8.6193127	11.3806873	10.0003758	11.3810631	37
24	8.6219616	9.9996189	8.6223427	11.3776573	10.0003811	11.3780384	36
25	8.62496[illegible]	9.9996136	8.6253518	11.3746482	10.0003864	11.3750347	35
26	8.6279484	9.9996082	8.6283402	11.3716598	10.0003918	11.3720516	34
27	8.6309111	9.9996028	8.6313083	11.3686917	10.0003972	11.3690889	33
28	8.6338537	9.9995974	8.6342563	11.3657437	10.0004026	11.3661463	32
29	8.6367764	9.9995919	8.6371845	11.3628155	10.0004181	11.3632236	31
30	8.6396796	9.9995865	8.6400931	11.3599059	10.0004135	11.3603204	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

87 DEGREES.

Latitude 4 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	[illegible]		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.[illegible]	1	00.4	1	[illegible]	2	00.7	2	00.9	[illegible]	0.11	1	0.12	2	0.14	2	0.16	2	0.18	2	0.20	2	0.22	1	0.23
2	00.7	3	0.1[illegible]	3	0.1[illegible]	3	0.16	3	0.19	4	0.22	3	0.26	3	0.29	4	0.33	4	0.37	4	0.41	3	0.45	3	0.48
3	0.1[illegible]	5	0.16	5	0.21	5	0.26	6	0.32	6	0.38	5	0.43	6	0.49	6	0.55	6	1.01	6	1.07	6	1.13	5	1.18
4	0.16	8	0.24	8	0.32	[illegible]	0.40	8	0.48	9	0.57	8	1.05	9	1.14	9	1.23	9	1.32	9	1.41	10	1.51	8	1.59
5	0.24	12	0.36	12	0.48	12	1.00	[illegible]	1.12	13	1.25	14	1.39	14	1.53	14	2.07	14	2.21	14	2.35	17	2.52	3	3.05
6	0.38	19	0.53	20	1.13	20	1.37	20	1.57	20	2.17	28	2.45	29	3.14	28	3.42	28	4.10	28	4.38	55	5.33		
7	1.1[illegible]	45	2.02	45	2.47	45	3.2[illegible]	45	4.17	46	5.03														
NE																									

2 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	436194	9990482	436609	22903765	10009527	22925586	30
31	439100	9990355	439524	22751892	10009655	22773857	29
32	442006	9990227	442438	22602015	10009783	22624126	28
33	444912	9990098	445353	22454096	10009912	22476352	27
34	447818	9989968	448268	22308097	10010042	22330499	26
35	450724	9989837	451182	22163980	10010173	22186528	25
36	453630	9989705	454097	22021710	10010305	22044403	24
37	456536	9989573	457012	21881251	10010438	21904090	23
38	459442	9989440	459927	21742569	10010571	21765553	22
39	462347	9989306	462842	21605630	10010705	21628759	21
40	465253	9989171	465757	21470401	10010840	21493676	20
41	468159	9989035	468673	21336851	10010976	21360272	19
42	471064	9988898	471588	21204949	10011113	21228515	18
43	473970	9988761	474503	21074664	10011251	21098375	17
44	476876	9988623	477419	20945966	10011390	20969824	16
45	479781	9988484	480334	20818828	10011530	20842830	15
46	482687	9988344	483250	20693220	10011670	20717368	14
47	485592	9988203	486166	20569115	10011811	20593409	13
48	488498	9988061	489082	20446486	10011953	20470925	12
49	491403	9987918	491997	20325307	10012096	20349892	11
50	494308	9987775	494913	20205553	10012240	20230284	10
51	497214	9987631	497829	20087199	10012385	20112075	9
52	500119	9987486	500746	19970219	10012530	19995241	8
53	503024	9987340	503662	19854591	10012676	19879758	7
54	505929	9987193	506578	19740291	10012823	19765604	6
55	508835	9987045	509495	19627296	10012971	19652754	5
56	511740	9986897	512411	19515584	10013120	19541187	4
57	514645	9986748	515328	19405133	10013270	19430882	3
58	517550	9986598	518244	19295922	10013420	19321816	2
59	520455	9986447	521161	19187930	10013571	19213970	1
60	523360	9986295	524078	19081137	10013723	19107323	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

87 DEGREES.

Latitude 5 Deg. 00 Min. North Declination.

	2			d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.			m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m	m.	h. m	m	h. m.	m.	h. m.
S N	12.0		N S		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.2		1				00.1	1	00.2	2	00.4	1	00.5	1	00.6	2	00.8	2	0.10	2	0.12	2	0.14	2	0.16
2	00.4		2				00.2	3	00.5	3	00.8	3	0.11	3	0.14	4	0.18	4	0.22	4	0.26	4	0.30	3	0.33
3	0.08		3				00.3	5	00.8	6	0.14	5	0.19	6	0.25	6	0.31	6	0.37	6	0.43	6	0.49	5	0.54
4	0.12		4				00.4	8	0.12	8	0.20	9	0.29	9	0.38	9	0.47	9	0.56	9	1.05	10	1.15	7	1.22
5	0.22		5				00.6	12	0.18	13	0.31	13	0.44	14	0.58	14	1.12	14	1.26	14	1.40	17	1.57	3	2.10
6	0.28		6				0.10	27	0.30	21	0.51	27	1.18	27	1.45	27	2.12	28	2.40	28	3.08	52	4.00		
7	0.54		7				0.15	53	1.08	53	2.01														
NE	4.12																								

2 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	8.6396796	9.9995865	8.6400931	11.3599069	10.0004135	11.3603204	30
31	8.6425634	9.9995809	8.6429825	11.3570175	10.0004191	11.3574366	29
32	8.6454282	9.9995753	8.6458528	11.3541472	10.0004247	11.3545718	28
33	8.6482742	9.9995697	8.6487044	11.3512956	10.0004303	11.3517258	27
34	8.6511016	9.9995641	8.6515375	11.3484625	10.0004359	11.3488984	26
35	8.6539107	9.9995584	8.6543522	11.3456478	10.0004416	11.3460893	25
36	8.6567017	9.9995527	8.6571490	11.3428510	10.0004473	11.3432983	24
37	8.6594748	9.9995469	8.6599279	11.3400721	10.0004530	11.3405252	23
38	8.6622303	9.9995411	8.6626891	11.3373109	10.0004589	11.3377697	22
39	8.6649684	9.9995353	8.6654331	11.3345669	10.0004647	11.3350316	21
40	8.6676893	9.9995295	8.6681598	11.3318402	10.0004705	11.3323107	20
41	8.6703932	9.9995236	8.6708697	11.3291303	10.0004764	11.3296068	19
42	8.6730804	9.9995176	8.6735628	11.3264372	10.0004824	11.3269196	18
43	8.6757510	9.9995116	8.6762393	11.3237607	10.0004884	11.3242490	17
44	8.6784052	9.9995056	8.6788996	11.3211004	10.0004944	11.3215948	16
45	8.6810433	9.9994996	8.6815437	11.3184563	10.0005004	11.3189567	15
46	8.6836654	9.9994935	8.6841719	11.3158281	10.0005065	11.3163346	14
47	8.6862718	9.9994874	8.6867844	11.3132156	10.0005126	11.3137282	13
48	8.6888625	9.9994812	8.6893813	11.3106187	10.0005188	11.3111375	12
49	8.6914379	9.9994750	8.6919629	11.3080371	10.0005250	11.3085621	11
50	8.6939980	9.9994688	8.6945292	11.3054708	10.0005312	11.3060019	10
51	8.6965431	9.9994625	8.6970806	11.3029194	10.0005375	11.3034569	9
52	8.6990734	9.9994562	8.6996173	11.3003828	10.0005438	11.3009266	8
53	8.7015889	9.9994498	8.7021390	11.2978610	10.0005502	11.2984111	7
54	8.7040899	9.9994435	8.7046465	11.2953535	10.0005565	11.2959101	6
55	8.7065766	9.9994370	8.7071395	11.2928605	10.0005630	11.2934234	5
56	8.7090490	9.9994306	8.7096185	11.2903815	10.0005694	11.2909510	4
57	8.7115075	9.9994241	8.7120834	11.2879166	10.0005759	11.2884925	3
58	8.7139520	9.9994176	8.7145345	11.2854655	10.0005824	11.2860480	2
59	8.7163829	9.9994110	8.7169719	11.2830281	10.0005890	11.2836171	1
60	8.7188002	9.9994044	8.7193958	11.2806042	10.0005956	11.2811998	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

87 DEGREES.

Latitude 5 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	b. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.4	1	00.5	1	00.6	2	00.8	2	0.10	2	0.12	1	0.13	1	0.14	2	0.16	2	0.18	2	0.20	2	0.22	2	0.24
2	00.8	3	0.11	3	0.14	3	0.17	3	0.21	4	0.25	3	0.28	3	0.31	4	0.35	4	0.39	4	0.43	4	0.47	3	0.50
3	0.13	5	0.18	5	0.23	5	0.28	6	0.34	6	0.40	5	0.45	6	0.57	6	0.57	6	1.02	6	1.09	7	1.16	5	1.21
4	0.20	8	0.28	8	0.36	8	0.44	8	0.52	8	1.00	9	1.09	9	1.18	9	1.27	9	1.36	9	1.45	10	1.55	7	2.02
5	0.30	12	0.42	13	0.55	13	1.08	13	1.21	13	1.34	13	1.47	13	2.00	13	2.13	13	2.26	14	2.40	16	2.56	15	3.11
6	0.48	19	1.07	19	1.26	20	1.46	20	2.06	20	2.26	27	2.53	27	3.20	27	3.47	28	4.15	28	4.43	52	5.35		
7	1.35	43	2.18	43	3.01	43	3.44	43	4.27	44	5.11														
NE	6.00																								

3 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	523360	9986295	524078	19081137	10013723	19107323	60
1	526264	9986142	526995	18975523	10013876	19001854	59
2	529169	9985989	529912	18871068	10014030	18897545	58
3	532074	9985835	532829	18767754	10014185	18794376	57
4	534979	9985680	535746	18665562	10014341	18692330	56
5	537883	9985524	538663	18564473	10014498	18591387	55
6	540788	9985367	541581	18464471	10014655	18491530	54
7	543693	9985209	544498	18365537	10014813	18392742	53
8	546597	9985050	547416	18267654	10014972	18295005	52
9	549502	9984891	550333	18170807	10015132	18198303	51
10	552406	9984731	553251	18074977	10015293	18102619	50
11	555311	9984570	556169	17980150	10015455	18007937	49
12	558215	9984408	559087	17886310	10015617	17914243	48
13	561119	9984245	562005	17793442	10015780	17821520	47
14	564024	9984081	564923	17701529	10015944	17729753	46
15	566928	9983916	567841	17610559	10016109	17638928	45
16	569832	9983751	570759	17520516	10016275	17549030	44
17	572736	9983585	573678	17431385	10016442	17460046	43
18	575640	9983418	576596	17343155	10016610	17371960	42
19	578544	9983250	579515	17255809	10016778	17284761	41
20	581448	9983081	582434	17169337	10016947	17198434	40
21	584352	9982911	585352	17083724	10017117	17112966	39
22	587256	9982741	588271	16998957	10017288	17028346	38
23	590160	9982570	591190	16915025	10017460	16944559	37
24	593064	9982398	594109	16831915	10017633	16861594	36
25	595967	9982225	597029	16749614	10017807	16779439	35
26	598871	9982051	599948	16668112	10017981	16698082	34
27	601775	9981876	602867	16587396	10018156	16617512	33
28	604678	9981701	605787	16507455	10018332	16537717	32
29	607582	9981525	608706	16428279	10018509	16458686	31
30	610485	9981348	611626	16349856	10018687	16380408	30
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co-Secant.	N. Secant.	M

86 DEGREES.

Latitude 6 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6		d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.		m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0	N S		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.3	1	00.2	1	00.1	1		00.1	2	00.3	1	00.4	2	0.06	2	0.08	2	0.10	2	0.12	2	0.14	1	0.15
2	00.6	2	00.4	2	00.2	2		00.3	4	00.7	3	0.10	3	0.13	4	0.17	4	0.21	4	0.25	4	0.29	2	0.31
3	0.10	4	00.6	4	00.2	3		00.6	5	0.11	5	0.16	6	0.22	6	0.28	6	0.34	6	0.40	6	0.46	5	0.51
4	0.16	6	0.10	7	00.3	4		00.7	9	0.16	9	0.25	9	0.34	9	0.43	9	0.52	9	1.01	9	1.10	8	1.18
5	0.24	10	0.14	10	00.4	5		0.12	13	0.25	13	0.38	14	0.52	14	1.06	14	1.20	14	1.34	16	1.50	14	2.04
6	0.37	15	0.22	16	00.6	6		0.18	22	0.40	15	0.55	15	1.10	15	1.25	15	1.40	15	1.55	49	3.44		
7	1.15	32	0.43	33	0.10	7		0.25	1.9	1.34														
NE	4.46	1.40	3.06	1.40	1.26																			

3 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	8.7188002	9.9994044	8.7193958	11.2806042	10.0005956	11.2811998	60
1	8.7212040	9.9993978	8.7218063	11.2781937	10.0006022	11.2787960	59
2	8.7235946	9.9993911	8.7242035	11.2757965	10.0006089	11.2764054	58
3	8.7259721	9.9993844	8.7265877	11.2734123	10.0006156	11.2740279	57
4	8.7283366	9.9993776	8.7289589	11.2710411	10.0006224	11.2716634	56
5	8.7306882	9.9993708	8.7313174	11.2686826	10.0006292	11.2693118	55
6	8.7330272	9.9993640	8.7336631	11.2663369	10.0006360	11.2669728	54
7	8.7353535	9.9993572	8.7359964	11.2640036	10.0006428	11.2646465	53
8	8.7376675	9.9993503	8.7383172	11.2616828	10.0006497	11.2623325	52
9	8.7399691	9.9993433	8.7406258	11.2593742	10.0006567	11.2600309	51
10	8.7422586	9.9993364	8.7429222	11.2570778	10.0006636	11.2577414	50
11	8.7445360	9.9993293	8.7452067	11.2547933	10.0006707	11.2554640	49
12	8.7468015	9.9993223	8.7474792	11.2525208	10.0006777	11.2531985	48
13	8.7490553	9.9993152	8.7497400	11.2502600	10.0006848	11.2509447	47
14	8.7512973	9.9993081	8.7519892	11.2480108	10.0006919	11.2487027	46
15	8.7535278	9.9993009	8.7542269	11.2457731	10.0006991	11.2464723	45
16	8.7557469	9.9992938	8.7564531	11.2435469	10.0007060	11.2442531	44
17	8.7579546	9.9992865	8.7586681	11.2413319	10.0007135	11.2420454	43
18	8.7601512	9.9992793	8.7608719	11.2391281	10.0007207	11.2398488	42
19	8.7623366	9.9992720	8.7630647	11.2369353	10.0007280	11.2376634	41
20	8.7645111	9.9992646	8.7652465	11.2347535	10.0007354	11.2354889	40
21	8.7666747	9.9992572	8.7674175	11.2325825	10.0007428	11.2333253	39
22	8.7688275	9.9992498	8.7695777	11.2304222	10.0007502	11.2311723	38
23	8.7709697	9.9992424	8.7717274	11.2282726	10.0007576	11.2290303	37
24	8.7731014	9.9992349	8.7738665	11.2261335	10.0007651	11.2268986	36
25	8.7752226	9.9992274	8.7759952	11.2240048	10.0007726	11.2247774	35
26	8.7773334	9.9992198	8.7781136	11.2218864	10.0007802	11.2226666	34
27	8.7794340	9.9992122	8.7802218	11.2197782	10.0007878	11.2205660	33
28	8.7815244	9.9992046	8.7823199	11.2176801	10.0007954	11.2184756	32
29	8.7836048	9.9991969	8.7844079	11.2155921	10.0008031	11.2163952	31
30	8.7856753	9.9991892	8.7864861	11.2135139	10.0008108	11.2143247	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

86 DEGREES.

Latitude 6 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.5	1	00.6	1	00.7	2	00.9	2	0.11		0.13	1	0.14	1	0.15	2	0.17	2	0.19	2	0.21	2	0.23	1	0.24
2	0.10	3	0.13	3	0.16	3	0.19	4	0.23	4	0.27	3	0.30	3	0.33	3	0.36	4	0.40	4	0.44	4	0.48	3	0.51
3	0.16	5	0.21	5	0.26	5	0.31	6	0.37	6	0.43	5	0.48	6	0.54	6	1.00	6	1.06	6	1.12	6	1.18	5	1.23
4	0.24	8	0.32	8	0.40	8	0.48	8	0.56	8	1.04	8	1.12	9	1.21	9	1.30	9	1.39	9	1.48	10	1.58	8	2.06
5	0.36	12	0.48	12	1.00	12	1.12	12	1.24	12	1.36	13	1.49	13	2.02	13	2.15	14	2.29	14	2.45	17	3.02	13	3.15
6	0.57	19	1.16	19	1.35	19	1.54	20	2.14	20	2.34	26	3.00	27	3.27	27	3.54	27	4.21	27	4.48	49	5.37		
7	1.51	41	2.32	41	3.13	41	3.54	41	4.35	41	5.16														
NE	6.00																								

3 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Targ.	N. Secant.	N. Co-Secant.	
30	610485	9981348	611626	16349855	10018687	16380408	30
31	613389	9981170	614546	16272174	10018866	16302873	29
32	616292	9980991	617466	16195225	10019046	16226069	28
33	619196	9980811	620386	16118998	10019226	16149987	27
34	622099	9980630	623306	16043482	10019407	16074617	26
35	625002	9980449	626226	15968667	10019589	15999948	25
36	627905	9980267	629147	15894545	10019772	15925971	24
37	630808	9980084	632067	15821104	10019956	15852676	23
38	633711	9979900	634988	15748337	10020141	15780054	22
39	636614	9979715	637908	15676233	10020326	15708096	21
40	639517	9979529	640829	15604784	10020512	15636793	20
41	642420	9979343	643750	15533981	10020699	15566135	19
42	645323	9979156	646671	15463814	10020887	15496114	18
43	648226	9978968	649592	15394276	10021076	15426721	17
44	651129	9978779	652513	15325358	10021266	15357949	16
45	654031	9978589	655435	15257052	10021457	15289788	15
46	656934	9978398	658356	15189349	10021649	15222231	14
47	659836	9978206	661278	15122242	10021841	15155270	13
48	662739	9978014	664199	15055723	10022034	15088896	12
49	665641	9977821	667121	14989784	10022228	15023103	11
50	668544	9977627	670043	14924417	10022423	14957882	10
51	671446	9977432	672965	14859615	10022619	14893226	9
52	674348	9977236	675887	14795372	10022816	14829128	8
53	677251	9977039	678809	14731679	10023013	14765580	7
54	680153	9976842	681732	14668529	10023211	14702576	6
55	683055	9976644	684654	14605916	10023410	14640109	5
56	685957	9976445	687577	14543833	10023610	14578171	4
57	688859	9976245	690499	14482273	10023811	14516767	3
58	691761	9976044	693422	14421230	10024013	14455859	2
59	694663	9975842	696345	14360696	10024216	14395471	1
60	697565	9975640	699268	14300666	10024419	14335587	0
	N. Co-Sine.	N. Sine.	N.Co-Targ	N. Targent.	N.Co Secant.	N. Secant.	M

86 DEGREES.

Latitude 7 Deg. 00 Min. North Declination.

	2	d.	4	d	6			d.	8	d	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d	23½
	h. m.	m.	h. m.	m.	h. m.			m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		N S		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.4	1	00.3	2	00.1		1		00.1	1	00.2	1	00.3	2	0.05	2	0.07	2	0.09	2	0.11	2	0.13	1	0.14
2	00.7	2	00.5	3	00.2		2		00.2	3	00.5	3	00.8	3	0.11	4	0.15	4	0.19	4	0.23	4	0.27	3	0.30
3	0.13	4	00.9	5	00.4		3		00.3	5	00.8	5	0.13	5	0.18	6	0.24	6	0.30	6	0.36	8	0.44	4	0.48
4	0.20	7	0.13	7	00.6		4		00.4	8	0.12	8	0.20	9	0.29	9	0.38	9	0.47	9	0.56	10	1.06	8	1.14
5	0.30	11	0.19	11	00.8		5		00.5	13	0.18	13	0.31	14	0.45	14	0.59	14	1.13	14	1.27	16	1.43	4	1.57
6	0.47	17	0.30	17	0.13		6		00.6	24	0.30	26	0.56	26	1.22	26	1.48	27	2.15	27	2.42	46	3.28		
7	1.31	30	1.08	30	0.31		7		0.22	56	1.08	1.11	2.19												
NE	4.55	1.7	3.48	1.8	2.40																				

3 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	8.7856753	9.9991892	8.7864861	11.2135139	10.0008108	11.2143247	30
31	8.7877359	9.9991815	8.7885544	11.2114456	10.0008185	11.2122641	29
32	8.7897867	9.9991737	8.7906130	11.2093870	10.0008263	11.2102133	28
33	8.7918278	9.9991659	8.7926620	11.2073380	10.0008341	11.2081722	27
34	8.7938594	9.9991580	8.7947014	11.2052986	10.0008420	11.2061406	26
35	8.7958814	9.9991501	8.7967313	11.2032687	10.0008499	11.2041186	25
36	8.7978941	9.9991422	8.7987519	11.2012481	10.0008578	11.2021059	24
37	8.7998974	9.9991342	8.8007632	11.1992368	10.0008658	11.2001026	23
38	8.8018915	9.9991262	8.8027653	11.1972347	10.0008738	11.1981085	22
39	8.8038764	9.9991182	8.8047583	11.1952417	10.0008818	11.1961236	21
40	8.8058523	9.9991101	8.8067422	11.1932578	10.0008899	11.1941477	20
41	8.8078192	9.9991020	8.8087172	11.1912828	10.0008980	11.1921808	19
42	8.8097772	9.9990938	8.8106834	11.1893166	10.0009062	11.1902228	18
43	8.8117264	9.9990856	8.8126407	11.1873593	10.0009144	11.1882736	17
44	8.8136668	9.9990774	8.8145894	11.1854106	10.0009226	11.1863332	16
45	8.8155985	9.9990691	8.8165294	11.1834706	10.0009309	11.1844015	15
46	8.8175217	9.9990608	8.8184608	11.1815392	10.0009392	11.1824783	14
47	8.8194363	9.9990525	8.8203838	11.1796162	10.0009475	11.1805637	13
48	8.8213425	9.9990441	8.8222984	11.1777016	10.0009559	11.1786575	12
49	8.8232404	9.9990357	8.8242046	11.1757954	10.0009643	11.1767596	11
50	8.8251299	9.9990273	8.8261026	11.1738974	10.0009727	11.1748701	10
51	8.8270112	9.9990188	8.8279924	11.1720076	10.0009812	11.1729888	9
52	8.8288844	9.9990103	8.8298741	11.1701259	10.0009897	11.1711156	8
53	8.8307495	9.9990017	8.8317478	11.1682522	10.0009983	11.1692505	7
54	8.8326066	9.9989931	8.8336134	11.1663866	10.0010069	11.1673934	6
55	8.8344557	9.9989845	8.8354712	11.1645288	10.0010155	11.1655443	5
56	8.8362969	9.9989758	8.8373211	11.1626789	10.0010242	11.1637031	4
57	8.8381304	9.9989671	8.8391633	11.1608367	10.0010329	11.1618696	3
58	8.8399561	9.9989584	8.8409977	11.1590023	10.0010416	11.1600439	2
59	8.8417741	9.9989496	8.8428245	11.1571755	10.0010504	11.1582259	1
60	8.8435845	9.9989408	8.8446437	11.1553563	10.0010592	11.1564155	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

86 DEGREES.

Latitude 7 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d	23½
	h. m	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.6	1	00.7	1	00.8	1	00.9	2	0.11	2	0.13	1	0.14	1	0.16	2	0.18	2	0.20	2	0.22	2	0.24	1	0.25
2	0.12	3	0.15	3	0.18	3	0.21	3	0.24	4	0.28	3	0.31	3	0.34	4	0.38	4	0.42	4	0.46	4	0.50	3	0.53
3	0.19	5	0.24	5	0.29	5	0.34	5	0.39	6	0.45	5	0.50	5	0.55	6	1.01	6	1.07	6	1.13	8	1.21	4	1.25
4	0.28	8	0.36	8	0.44	8	0.52	8	1.00	8	1.08	9	1.16	9	1.25	9	1.34	9	1.43	9	1.52	10	2.02	7	2.09
5	0.41	12	0.53	12	1.05	12	1.17	12	1.29	12	1.41	13	1.54	14	2.08	14	2.22	14	2.36	14	2.50	16	3.06	13	3.19
6	1.06	19	1.25	19	1.34	19	1.53	19	2.12	19	2.41	26	3.07	26	3.33	26	3.59	27	4.26	27	4.53	46	5.39		
7	2.06	38	2.44	39	3.23	39	4.02	39	4.41	39	5.20														
NE	6.00																								

4 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	697565	9975640	699268	14300666	10024419	14335587	60
1	700466	9975437	702191	14241134	10024623	14276200	59
2	703368	9975233	705115	14182092	10024828	14217304	58
3	706270	9975028	708038	14123536	10025034	14158894	57
4	709171	9974822	710961	14065459	10025241	14100962	56
5	712073	9974615	713885	14007856	10025449	14043504	55
6	714974	9974407	716809	13950719	10025658	13986514	54
7	717876	9974199	719733	13894045	10025868	13929985	53
8	720777	9973990	722657	13837827	10026078	13873913	52
9	723678	9973780	725581	13782060	10026289	13818291	51
10	726580	9973569	728505	13726738	10026501	13763115	50
11	729481	9973357	731430	13671856	10026714	13708379	49
12	732382	9973144	734354	13617409	10026928	13654077	48
13	735283	9972931	737279	13563391	10027143	13600205	47
14	738184	9972717	740203	135[illegible]9799	10027358	13546758	46
15	741085	9972502	7431[illegible]	13456625	10027574	13493731	45
16	743986	9972286	746[illegible]53	13403367	10027791	13441118	44
17	746887	9972069	748979	13351518	10028009	13388914	43
18	749787	9971851	7519[illegible]	13299574	10028228	13337116	42
19	752688	9971632	754829	1324[illegible]31	10028448	13285719	41
20	755589	9971413	757755	[illegible]	10028668	13234716	40
21	758489	9971193	760[illegible]	13146127	10028889	13184106	39
22	761390	9970972	7[illegible]3606	1309[illegible]757	10029111	13133882	38
23	764290	9970750	7665[illegible]	13045769	10029334	13084040	37
24	767190	9970527	769[illegible]	12996160	10029558	13034576	36
25	770091	9970303	772384	12946924	10029783	12985486	35
26	772991	9970079	77[illegible]	12[illegible]98058	10030009	12936765	34
27	775891	9969854	77[illegible]37	12849557	10030236	12888410	33
28	778791	9969628	781164	12801417	10030464	12840415	32
29	781691	9969401	784090	12753634	10030693	12792779	31
30	784591	9969173	787017	12706205	10030922	12745495	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

85 DEGREES.

Latitude 8 Deg. 00 Min. North Declination.

	2	d.	4	d.	6	d.	8		d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.		m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0	N S		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.4	1	00.3	1	00.2	2	00.0	1		00.2	1	00.3	1	00.4	2	00.6	2	00.8	2	0.10	2	0.1[illegible]	1	0.13
2	00.9	3	00.6	3	00.3	3	00.0	2		00.3	3	00.6	3	00.9	4	0.13	4	0.17	4	0.21	3	[illegible]		0.28
3	0.16	5	0.11	5	00.6	6	00.0	3		00.5	5	0.10	6	0.16	6	0.22	6	0.2[illegible]	6	0.[illegible]4	7	[illegible]	4	0.45
4	0.24	8	0.16	8	00.8	8	00.0	4		00.8	8	0.16	9	0.25	9	0.34	9	0.43	[illegible]	0.[illegible]2	10	1.02	7	1.09
5	0.36	11	0.25	12	0.13	12	00.1	5		0.13	13	0.25	12	0.38	13	0.51	14	1.05	14	1.19	16	1.35	12	1.47
6	0.56	18	0.38	18	0.20	18	00.2	6		0.20	2[illegible]	0.45	[illegible]	1.10	[illegible]	1.36	[illegible]	2.0[illegible]	26	2.28	43	3.11	[illegible]	4.07
7	1.47	34	1.13	35	0.38	35	00.3	7		0.44	[illegible]	1.3[illegible]												
NE	5.02	1.22	3.40	1.22	2.18	1.22	0.56																	

4 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	8.8435845	9.9989408	8.8446437	11.1553563	10.0010592	11.1564155	60
1	8.8453874	9.9989319	8.8464554	11.1535446	10.0010681	11.1546126	59
2	8.8471827	9.9989230	8.8482597	11.1517403	10.0010770	11.1528173	58
3	8.8489707	9.9989141	8.8500566	11.1499434	10.0010859	11.1510293	57
4	8.8507512	9.9989052	8.8518461	11.1481539	10.0010948	11.1492488	56
5	8.8525245	9.9988962	8.8536283	11.1463717	10.0011038	11.1474755	55
6	8.8542905	9.9988871	8.8554034	11.1445966	10.0011129	11.1457095	54
7	8.8560493	9.9988780	8.8571713	11.1428287	10.0011220	11.1439507	53
8	8.8578010	9.9988689	8.8589321	11.1410679	10.0011311	11.1421990	52
9	8.8595457	9.9988598	8.8606859	11.1393141	10.0011402	11.1404543	51
10	8.8612833	9.9988506	8.8624327	11.1375673	10.0011494	11.1387167	50
11	8.8630139	9.9988414	8.8641725	11.1358275	10.0011586	11.1369861	49
12	8.8647376	9.9988321	8.8659055	11.1340945	10.0011679	11.1352624	48
13	8.8664545	9.9988228	8.8676317	11.1323683	10.0011772	11.1335455	47
14	8.8681646	9.9988135	8.8693511	11.1306489	10.0011865	11.1318354	46
15	8.8698680	9.9988041	8.8710638	11.1289362	10.0011959	11.130[illegible]520	45
16	8.8715646	9.9987947	8.8727699	11.1272301	10.0012053	11.1284354	44
17	8.8732546	9.9987853	8.8744694	11.1255306	10.0012147	11.1267454	43
18	8.8749381	9.9987758	8.8761623	11.1238377	10.0012242	11.1250619	42
19	8.8766150	9.9987663	8.8778487	11.1221513	10.0012337	11.1233850	41
20	8.8782854	9.9987567	8.8795286	11.1204714	10.0012433	11.1217146	40
21	8.8799493	9.9987471	8.8812022	11.1187978	10.0012529	11.1200507	39
22	8.8816069	9.9987375	8.8828694	11.1171306	10.0012625	11.1183931	38
23	8.8832581	9.9987278	8.8845303	11.1154697	10.0012722	11.1167419	37
24	8.8849031	9.9987181	8.8861850	11.1138150	10.0012819	11.1150969	36
25	8.8865418	9.9987084	8.8878334	11.1121666	10.0012916	11.1134582	35
26	8.8881743	9.9986986	8.8894757	11.1105243	10.0013014	11.1118257	34
27	8.8898007	9.9986888	8.8911119	11.1088881	10.0013112	11.1101993	33
28	8.8914209	9.9986790	8.8927420	11.1072580	10.0013210	11.1085791	32
29	8.8930351	9.9986691	8.8943660	11.1056340	10.0013309	11.1069649	31
30	8.8946433	9.9986591	8.8959842	11.1040158	10.0013409	11.1053567	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

85 DEGREES.

Latitude 8 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.6	1	00.7	1	00.8	2	0.10	2	0.12	2	0.14	1	0.15	2	0.17	2	0.19	2	0.21	2	0.23	2	0.25	1	0.[illegible]6
2	0.13	3	0.16	3	0.19	3	0.22	4	0.26	4	0.30	3	0.33	3	0.36	3	0.39	4	0.43	4	0.47	4	0.51	3	0.54
3	0.21	5	0.26	5	0.31	5	0.36	6	0.42	6	0.48	5	0.53	6	0.59	6	1.05	6	1.11	6	1.17	6	1.23	5	1.2[illegible]
4	0.32	7	0.39	8	0.47	8	0.55	8	1.03	8	1.11	8	1.19	9	1.28	9	1.37	9	1.46	9	1.55	10	2.0[illegible]	8	2.1[illegible]
5	0.47	11	0.58	12	1.10	12	1.22	12	1.34	12	1.46	13	1.59	13	2.12	13	2.25	14	2.39	14	2.53	16	[illegible]	13	[illegible]
6	1.14	18	1.32	19	1.51	19	2.10	19	2.29	19	2.48	25	3.13	25	3.38	26	4.04	26	4.30	26	4.56	43	5.39		
7	2.20	36	2.56	37	3.33	37	4.10	37	4.47	37	5.24														
NE	6.00																								

4 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	784591	9969173	787017	12706205	10030922	12745495	30
31	787491	9968944	789944	12659125	10031152	12698560	29
32	790391	9968715	792871	12612390	10031383	12651971	28
33	793290	9968485	795798	12565997	10031615	12605724	27
34	796190	9968254	798726	12519942	10031848	12559815	26
35	799090	9968022	801653	12474221	10032081	12514240	25
36	801989	9967789	804581	12428831	10032315	12468995	24
37	804889	9967555	807509	12383768	10032550	12424078	23
38	807788	9967320	810437	12339028	10032786	12379484	22
39	810687	9967085	813365	12294608	10033023	12335210	21
40	813587	9966849	816293	12250506	10033261	12291252	20
41	816486	9966612	819221	12206716	10033500	12247608	19
42	819385	9966374	822150	12163236	10033740	12204274	18
43	822284	9966135	825078	12120062	10033980	12161246	17
44	825183	9965895	828007	12077192	10034221	12118522	16
45	828082	9965655	830936	12034622	10034463	12076098	15
46	830981	9965414	833865	11992349	10034706	12033970	14
47	833880	9965172	836794	11950370	10034950	11992137	13
48	836778	9964929	839723	11908682	10035195	11950595	12
49	839677	9964685	842653	11867282	10035441	11909340	11
50	842576	9964440	845583	11826167	10035687	11868370	10
51	845474	9964194	848512	11785333	10035934	11827683	9
52	848373	9963948	851442	11744779	10036182	11787274	8
53	851271	9963701	854372	11704500	10036431	11747141	7
54	854169	9963453	857302	11664495	10036681	11707282	6
55	857067	9963204	860233	11624761	10036932	11667693	5
56	859966	9962954	863163	11585294	10037184	11628372	4
57	862864	9962703	866094	11546093	10037436	11589316	3
58	865762	9962452	869025	11507154	10037689	11550523	2
59	868660	9962200	871956	11468474	10037943	11511990	1
60	871557	9961947	874887	11430052	10038198	11473713	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

85 DEGREES.

Latitude 9 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d	8			d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.			m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		N S		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.5	1	00.4	1	00.3	2	00.1		1		00.1	1	00.2	1	0.03	2	0.05	2	0.07	2	00.9	2	0.11	1	0.12
2	0.11	3	00.8	3	00.5	3	00.2		2		00.2	3	00.5	3	00.8	3	0.11	4	0.15	4	0.19	4	0.23	3	0.26
3	0.18	5	0.13	5	00.8	5	00.3		3		00.3	5	00.8	5	0.13	6	0.19	6	0.25	6	0.31	7	0.38	5	0.43
4	0.28	8	0.20	8	0.12	8	00.4		4		00.4	8	0.12	8	0.20	9	0.29	9	0.38	9	0.47	10	0.57	8	1.05
5	0.40	11	0.29	11	0.18	12	00.6		5		0.06	13	0.19	13	0.32	14	0.46	14	1.00	14	1.14	16	1.30	12	1.42
6	1.03	17	0.46	18	0.28	18	0.10		6		0.10	25	0.35	25	1.00	25	1.25	25	1.50	25	2.15	40	2.55	47	3.42
7	1.58	32	1.26	32	0.54	33	0.21		7		0.21	54	1.15												
NE	5.08	1.2	4.06	1.3	3.03	1.3	2.00																		

4 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	8.8946433	9.9986591	8.8959842	11.1040158	10.0013409	11.1053567	30
31	8.8962455	9.9986492	8.8975963	11.1024037	10.0013508	11.1037545	29
32	8.8978418	9.9986392	8.8992026	11.1007974	10.0013608	11.1021582	28
33	8.8994322	9.9986292	8.9008030	11.0991970	10.0013708	11.1005678	27
34	8.9010168	9.9986191	8.9023977	11.0976023	10.0013809	11.0989832	26
35	8.9025955	9.9986090	8.9039866	11.0960134	10.0013910	11.0974045	25
36	8.9041685	9.9985988	8.9055697	11.0944303	10.0014012	11.0958315	24
37	8.9057358	9.9985886	8.9071472	11.0928528	10.0014014	11.0942642	23
38	8.9072975	9.9985784	8.9087190	11.0912810	10.0014216	11.0927025	22
39	8.9088535	9.9985682	8.9102853	11.0897147	10.0014318	11.0911465	21
40	8.9104039	9.9985579	8.9118460	11.0881540	10.0014421	11.0895961	20
41	8.9119487	9.9985475	8.9134012	11.0865988	10.0014525	11.0880513	19
42	8.9134881	9.9985372	8.9149509	11.0850491	10.0014628	11.0865119	18
43	8.9150219	9.9985268	8.9164952	11.0835048	10.0014732	11.0849781	17
44	8.9165504	9.9985163	8.9180340	11.0819660	10.0014837	11.0834496	16
45	8.9180734	9.9985058	8.9195675	11.0804325	10.0014942	11.0819265	15
46	8.9195911	9.9984953	8.9210957	11.0789043	10.0015047	11.0804089	14
47	8.9211034	9.9984848	8.9226186	11.0773814	10.0015152	11.0788966	13
48	8.9226105	9.9984742	8.9241363	11.0758637	10.0015258	11.0773895	12
49	8.9241123	9.9984636	8.9256487	11.0743513	10.0015364	11.0758877	11
50	8.9256089	9.9984529	8.9271560	11.0728440	10.0015471	11.0743911	10
51	8.9271003	9.9984422	8.9286581	11.0713419	10.0015578	11.0728997	9
52	8.9285866	9.9984315	8.9301552	11.0698448	10.0015685	11.0714134	8
53	8.9300678	9.9984207	8.9316471	11.0683529	10.0015793	11.0699522	7
54	8.9315439	9.9984099	8.9331340	11.0668660	10.0015901	11.0684561	6
55	8.9330150	9.9983990	8.9346160	11.0653840	10.0016010	11.0669850	5
56	8.9344811	9.9983881	8.9360929	11.0639071	10.0016119	11.0655189	4
57	8.9359422	9.9983772	8.9375650	11.0624350	10.0016228	11.0640578	3
58	8.9373983	9.9983663	8.9390321	11.0609679	10.0016337	11.0626017	2
59	8.9388496	9.9983553	8.9404944	11.0595056	10.0016447	11.0611504	1
60	8.9402960	9.9983442	8.9419518	11.0580482	10.0016558	11.0597040	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

85 DEGREES.

Latitude 9 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.7	1	00.8	1	00.9	2	0.11	2	0.13	2	0.15	1	0.16	2	0.18	2	0.20	2	0.22	2	0.24	2	0.26	1	0.27
2	0.15	3	0.18	3	0.21	3	0.24	3	0.27	4	0.31	3	0.34	3	0.37	4	0.41	4	0.45	4	0.49	5	0.54	2	0.56
3	0.24	5	0.29	5	0.34	5	0.39	5	0.44	6	0.50	5	0.55	6	1.01	6	1.07	6	1.13	6	1.19	7	1.26	5	1.31
4	0.36	7	0.43	8	0.51	8	0.59	8	1.07	8	1.15	8	1.23	9	1.32	9	1.41	9	1.50	9	1.59	10	2.09	7	2.16
5	0.53	11	1.04	12	1.16	12	1.28	12	1.40	12	1.52	13	2.05	13	2.18	13	2.31	14	2.45	14	2.59	16	3.15	13	3.28
6	1.23	18	1.41	18	1.59	18	2.17	19	2.36	19	2.55	25	3.20	25	3.45	25	4.10	25	4.35	25	5.00	40	5.40		
7	2.33	34	3.07	35	3.42	35	4.17	35	4.52	35	5.27														
NE	6.00																								

5 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	871557	9961947	874887	11430052	10038198	11473713	60
1	874455	9961693	877818	11391885	10038454	11435692	59
2	877353	9961438	880749	11353970	10038711	11397922	58
3	880251	9961182	883681	11316304	10038969	11360402	57
4	883148	9960926	886612	11278885	10039228	11323129	56
5	886046	9960669	889544	11241712	10039487	11286101	55
6	888943	9960411	892476	11204780	10039747	11249316	54
7	891840	9960152	895408	11168089	10040008	11212770	53
8	894738	9959892	898341	11131634	10040270	11176462	52
9	897635	9959631	901273	11095416	10040533	11140389	51
10	900532	9959369	904206	11059431	10040797	11104549	50
11	903429	9959107	907138	11023676	10041061	11068940	49
12	906326	9958844	910071	10988150	10041326	11033560	48
13	909223	9958580	913004	10952850	10041592	10998406	47
14	912119	9958315	915938	10917775	10041859	10963476	46
15	915016	9958049	918871	10882921	10042127	10928768	45
16	917913	9957782	921804	10848288	10042396	10894281	44
17	920809	9957515	924738	10813872	10042666	10860011	43
18	923706	9957247	927672	10779673	10042937	10825957	42
19	926602	9956978	930606	10745687	10043208	10792117	41
20	929499	9956708	933540	10711913	10043480	10758488	40
21	932395	9956437	936474	10678348	10043753	10725070	39
22	935291	9956165	939409	10644992	10044027	10691859	38
23	938187	9955892	942344	10611841	10044302	10658854	37
24	941083	9955619	945278	10578895	10044578	10626054	36
25	943979	9955345	948213	10546151	10044855	10593455	35
26	946875	9955070	951148	10513607	10045133	10561057	34
27	949771	9954794	954084	10481261	10045411	10528857	33
28	952666	9954517	957019	10449112	10045690	10496854	32
29	955562	9954240	959955	10417158	10045970	10465046	31
30	958458	9953962	962890	10385397	10046251	10433430	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N.Co-Secant.	N. Secant.	M

84 DEGREES.

Latitude 10 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d	8		10			d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.					m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0				N S		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.6	1	00.5	1	00.4	2	00.2				1		00.2	1	0.03	1	0.04	2	0.06	2	00.8	2	0.10	2	0.12
2	0.12	3	0.10	3	00.7	3	00.4				2		00.4	3	00.7	3	0.10	4	0.15	4	0.18	3	0.21	3	0.24
3	0.21	5	0.16	5	0.11	5	00.6		Zenith. West.		3		00.6	5	0.11	6	0.17	6	0.23	6	0.29	6	0.35	5	0.40
4	0.32	7	0.25	8	0.17	8	00.9				4		00.8	8	0.16	9	0.25	9	0.34	9	0.43	10	0.53	7	1.00
5	0.46	11	0.35	11	0.24	12	0.12				5		0.12	13	0.25	13	0.38	14	0.52	14	1.06	17	1.23	12	1.35
6	1.12	17	0.55	17	0.38	18	0.20				6		0.20	25	0.45	25	1.10	25	1.35	26	2.01	38	2.39	40	3.19
7	2.11	30	1.41	30	1.11	31	0.40				7		0.36	1.41	2.17										
N E	5.13	52	4.21	52	3.29	53	2.36																		

5 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	8.9402960	9.9983442	8.9419518	11.0580482	10.0016558	11.0597040	60
1	8.9417376	9.9983332	8.9434044	11.0565956	10.0016668	11.0582624	59
2	8.9431743	9.9983220	8.9448523	11.0551477	10.0016780	11.0568257	58
3	8.9446063	9.9983109	8.9462954	11.0537046	10.0016891	11.0553937	57
4	8.9460335	9.9982997	8.9477338	11.0522662	10.0017003	11.0539665	56
5	8.9474561	9.9982885	8.9491676	11.0508324	10.0017115	11.0525439	55
6	8.9488739	9.9982772	8.9505967	11.0494033	10.0017228	11.0511261	54
7	8.9502871	9.9982660	8.9520211	11.0479789	10.0017340	11.0497129	53
8	8.9516957	9.9982546	8.9534410	11.0465590	10.0017454	11.0483043	52
9	8.9530996	9.9982433	8.9548564	11.0451436	10.0017567	11.0469004	51
10	8.9544991	9.9982318	8.9562672	11.0437328	10.0017682	11.0455009	50
11	8.9558940	9.9982204	8.9576735	11.0423265	10.0017796	11.0441060	49
12	8.9572843	9.9982089	8.9590754	11.0409246	10.0017911	11.0427157	48
13	8.9586703	9.9981974	8.9604728	11.0395272	10.0018026	11.0413297	47
14	8.9600517	9.9981859	8.9618659	11.0381341	10.0018141	11.0399483	46
15	8.9614288	9.9981743	8.9632545	11.0367455	10.0018257	11.0385712	45
16	8.9628014	9.9981626	8.9646388	11.0353612	10.0018371	11.0371986	44
17	8.9641697	9.9981510	8.9660188	11.0339812	10.0018490	11.0358303	43
18	8.9655337	9.9981393	8.9673944	11.0326056	10.0018607	11.0344663	42
19	8.9668934	9.9981275	8.9687658	11.0312342	10.0018725	11.0331066	41
20	8.9682487	9.9981158	8.9701330	11.0298670	10.0018842	11.0317513	40
21	8.9695999	9.9981040	8.9714959	11.0285041	10.0018960	11.0304001	39
22	8.9709468	9.9980921	8.9728547	11.0271453	10.0019079	11.0290532	38
23	8.9722895	9.9980802	8.9742092	11.0257908	10.0019198	11.0277105	37
24	8.9736280	9.9980683	8.9755597	11.0244403	10.0019317	11.0263720	36
25	8.9749624	9.9980563	8.9769060	11.0230940	10.0019437	11.0250376	35
26	8.9762926	9.9980443	8.9782483	11.0217517	10.0019557	11.0237074	34
27	8.9776188	9.9980323	8.9795865	11.0204135	10.0019677	11.0223812	33
28	8.9789408	9.9980202	8.9809206	11.0190794	10.0019798	11.0210592	32
29	8.9802589	9.9980081	8.9822507	11.0177493	10.0019919	11.0197411	31
30	8.9815729	9.9979960	8.9835769	11.0164231	10.0020040	11.0184271	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

84 DEGREES.

Latitude 10 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.8	1	0.09	1	0.10	2	0.12	2	0.14	2	0.16	1	0.17	1	0.18	2	0.20	2	0.22	2	0.24	2	0.26	1	0.27
2	0.16	3	0.19	3	0.22	3	0.25	4	0.29	4	0.33	3	0.36	3	0.39	4	0.43	4	0.47	4	0.51	3	0.54	3	0.57
3	0.26	5	0.31	5	0.36	5	0.41	6	0.47	6	0.53	5	0.58	6	1.04	6	1.10	6	1.16	6	1.22	6	1.28	5	1.33
4	0.39	8	0.47	8	0.55	8	1.03	8	1.11	8	1.19	8	1.27	8	1.35	9	1.44	9	1.53	9	2.02	10	2.12	7	2.19
5	0.58	11	1.09	12	1.21	12	1.33	12	1.45	12	1.57	13	2.10	13	2.23	13	2.36	13	2.49	14	3.03	16	3.19	13	3.32
6	1.31	18	1.49	18	2.07	18	2.25	18	2.43	19	3.02	24	3.26	24	3.50	24	4.14	24	4.38	25	5.03	38	5.41		
7	2.44	33	3.17	33	3.50	33	4.23	33	4.56	33	5.29														
N E	6.00																								

5 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	958458	9953962	962890	10385397	10046251	10433430	30
31	961353	9953683	965826	10353827	10046533	10402007	29
32	964248	9953403	968763	10322447	10046816	10370772	28
33	967144	9953122	971699	10291255	10047099	10339726	27
34	970039	9952840	974635	10260249	10047383	10308866	26
35	972934	9952557	977572	10229428	10047668	10278190	25
36	975829	9952274	980509	10198789	10047954	10247697	24
37	978724	9951990	983446	10168332	10048241	10217385	23
38	981619	9951705	986383	10138054	10048529	10187254	22
39	984514	9951419	989320	10107954	10048818	10157300	21
40	987408	9951132	992257	10078031	10049108	10127522	20
41	990303	9950844	995195	10048283	10049399	10097920	19
42	993197	9950555	998133	10018708	10049690	10068491	18
43	996092	9950265	1001071	99893050	10049982	10039234	17
44	998986	9949976	1004009	99600724	10050275	10010147	16
45	1001881	9949685	1006947	99310088	10050569	99812291	15
46	1004775	9949393	1009885	99021125	10050864	99524787	14
47	1007669	9949100	1012824	98733823	10051160	99238943	13
48	1010563	9948806	1015763	98448166	10051457	98954744	12
49	1013457	9948512	1018702	98164140	10051754	98672176	11
50	1016350	9948217	1021641	97881732	10052052	98391227	10
51	1019245	9947921	1024580	97600927	10052351	98111880	9
52	1022138	9947624	1027520	97321713	10052651	97834124	8
53	1025032	9947326	1030460	97044075	10052952	97557944	7
54	1027925	9947027	1033400	96768000	10053254	97283327	6
55	1030819	9946728	1036340	96493475	10053557	97010260	5
56	1033712	9946428	1039280	96220486	10053860	96738730	4
57	1036605	9946127	1042220	95949022	10054164	96468724	3
58	1039499	9945825	1045160	95679068	10054469	96200229	2
59	1042392	9945522	1048101	95410613	10054775	95933233	1
60	1045285	9945218	1051042	95143645	10055082	95667722	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

84 DEGREES.

Latitude 11 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d.	8	d.	10			d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.			m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		N S		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.07	1	00.6	1	00.5	2	00.3	2	00.1		1		00.0	1	00.1	2	00.3	2	0.05	2	00.7	2	00.9	2	0.11
2	0.14	3	0.11	3	00.8	3	00.5	3	00.2		2		00.1	3	00.4	4	00.8	4	0.12	4	0.16	4	0.20	2	0.22
3	0.22	4	0.18	5	0.13	5	00.8	5	00.3		3		00.3	5	00.8	6	0.14	6	0.20	6	0.26	8	0.34	3	0.37
4	0.36	8	0.28	8	0.20	8	0.12	8	00.4		4		00.5	8	0.13	8	0.21	9	0.30	9	0.39	13	0.52	4	0.56
5	0.53	11	0.42	12	0.30	12	0.18	12	00.6		5		00.7	13	0.20	13	0.33	13	0.46	14	1.00	15	1.15	13	1.28
6	1.21	18	1.03	18	0.45	18	0.27	19	0.08		6		0.12	23	0.35	24	0.59	24	1.23	24	1.47	36	2.23	36	2.59
7	2.26	31	1.55	31	1.24	32	0.52	32	0.20		7		0.23												
NE	5.18	44	4.34	45	3.49	45	3.04	45	2.19																

5 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	8.9815729	9.9979960	8.9835769	11.0164231	10.0020040	11.0184271	30
31	8.9828829	9.9979838	8.9848991	11.0151009	10.0020162	11.0171171	29
32	8.9841889	9.9979716	8.9862173	11.0137827	10.0020284	11.0158111	28
33	8.9854910	9.9979593	8.9875317	11.0124683	10.0020407	11.0145090	27
34	8.9867891	9.9979470	8.9888421	11.0111579	10.0020530	11.0132109	26
35	8.9880834	9.9979347	8.9901487	11.0098513	10.0020653	11.0119166	25
36	8.9893737	9.9979223	8.9914514	11.0085486	10.0020777	11.0106263	24
37	8.9906602	9.9979099	8.9927503	11.0072497	10.0020901	11.0093398	23
38	8.9919429	9.9978975	8.9940454	11.0059546	10.0021025	11.0080572	22
39	8.9932217	9.9978850	8.9953367	11.0046633	10.0021150	11.0067783	21
40	8.9944968	9.9978725	8.9966243	11.0033757	10.0021275	11.0055032	20
41	8.9957681	9.9978599	8.9979081	11.0020918	10.0021410	11.0042319	19
42	8.9970356	9.9978473	8.9991883	11.0008117	10.0021527	11.0029644	18
43	8.9982994	9.9978347	9.0004647	10.9995353	10.0021653	11.0017006	17
44	8.9995595	9.9978220	9.0017375	10.9982625	10.0021780	11.0004405	16
45	9.0008160	9.9978093	9.0030066	10.9969934	10.0021907	10.9991840	15
46	9.0020687	9.9977966	9.0042721	10.9957279	10.0022034	10.9979313	14
47	9.0033179	9.9977838	9.0055340	10.9944660	10.0022162	10.9966821	13
48	9.0045634	9.9977710	9.0067924	10.9932076	10.0022290	10.9954366	12
49	9.0058053	9.9977582	9.0080471	10.9919529	10.0022418	10.9941947	11
50	9.0070436	9.9977453	9.0092984	10.9907016	10.0022547	10.9929564	10
51	9.0082784	9.9977323	9.0105461	10.9894539	10.0022677	10.9917216	9
52	9.0095096	9.9977194	9.0117903	10.9882097	10.0022806	10.9904904	8
53	9.0107374	9.9977064	9.0130310	10.9869690	10.0022036	10.9892626	7
54	9.0119616	9.9976933	9.0142682	10.9857318	10.0023067	10.9880384	6
55	9.0131823	9.9976803	9.0155021	10.9844979	10.0023197	10.9868177	5
56	9.0143996	9.9976672	9.0167325	10.9832675	10.0023328	10.9856004	4
57	9.0156135	9.9976540	9.0179594	10.9820406	10.0023460	10.6843865	3
58	9.0168239	9.9976408	9.0191831	10.9808169	10.0023592	10.9831761	2
59	9.0180309	9.9976276	9.0204033	10.9795967	10.0023724	10.9819691	1
60	9.0192346	9.9976143	9.0216202	10.9783798	10.0023857	10.9807654	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

84 DEGREES.

Latitude 11 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.9	1	0.10	1	0.11	2	0.13	2	0.15	2	0.17	1	0.18	1	0.19	2	0.21	2	0.23	2	0.25	2	0.27	1	0.28
2	0.18	3	0.21	3	0.24	3	0.27	3	0.30	4	0.34	3	0.37	3	0.40	4	0.44	4	0.48	4	0.52	4	0.56	3	0.59
3	0.29	5	0.34	5	0.39	5	0.44	5	0.49	6	0.55	5	1.00	6	1.06	6	1.12	6	1.18	6	1.24	6	1.30	5	1.35
4	0.43	7	0.50	8	0.58	8	1.06	8	1.14	8	1.22	8	1.30	8	1.38	9	1.47	9	1.56	9	2.05	10	2.15	7	2.22
5	1.04	11	1.15	11	1.26	11	1.37	12	1.49	12	2.01	13	2.14	13	2.27	13	2.40	13	2.53	14	3.07	16	3.23	12	3.35
6	1.39	18	1.57	18	2.15	18	2.33	18	2.51	19	3.10	23	3.33	23	3.56	23	4.19	23	4.42	23	5.05	36	5.41		
7	2.55	31	3.26	31	3.57	31	4.28	31	4.59	32	5.31														
NE	6.00																								

6 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	1045285	9945218	1051042	95143645	10055082	95667722	60
1	1048178	9944914	1053983	94878149	10055390	95403686	59
2	1051070	9944609	1056924	94614116	10055699	95141110	58
3	1053963	9944303	1059866	94351531	10056009	94879984	57
4	1056856	9943996	1062808	94090384	10056320	94620296	56
5	1059748	9943688	1065750	93830663	10056631	94362033	55
6	1062641	9943379	1068692	93572355	10056943	94105184	54
7	1065533	9943069	1071634	93315450	10057256	93849738	53
8	1068425	9942759	1074576	93059936	10057570	93595682	52
9	1071318	9942448	1077519	92805802	10057885	93343006	51
10	1074210	9942136	1080462	92553035	10058201	93091699	50
11	1077102	9941823	1083405	92301627	10058518	92841749	49
12	1079994	9941509	1086348	92051564	10058835	92593145	48
13	1082885	9941194	1089291	91802838	10059153	92345877	47
14	1085777	9940879	1092234	91555436	10059472	92099934	46
15	1088669	9940563	1095178	91309348	10059792	91855305	45
16	1091560	9940246	1098122	91064564	10060113	91611980	44
17	1094452	9939928	1101066	90821074	10060435	91369949	43
18	1097343	9939609	1104010	90578867	10060758	91129200	42
19	1100234	9939289	1106954	90337933	10061081	90889725	41
20	1103126	9938969	1109899	90098261	10061405	90651512	40
21	1106017	9938648	1112844	89859843	10061730	90414553	39
22	1108908	9938325	1115789	89622668	10062056	90178837	38
23	1111799	9938003	1118734	89386726	10062383	89944354	37
24	1114689	9937679	1121679	89152008	10062711	89711095	36
25	1117580	9937354	1124625	88918505	10063040	89479051	35
26	1120471	9937028	1127571	88686205	10063370	89248211	34
27	1123361	9936702	1130517	88455103	10063701	89018567	33
28	1126252	9936375	1133463	88225186	10064032	88790109	32
29	1129142	9936047	1136409	87996446	10064364	88562828	31
30	1132032	9935718	1139356	87768874	10064697	88336715	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

83 DEGREES.

Latitude 12 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d.	8	d.	10		d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.		m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0	N S		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.07	1	00.6	1	00.5	1	00.4	2	00.2	1		00.0	1	00.1	2	00.3	2	0.05	2	00.7	2	00.9	1	0.10
2	0.16	3	0.13	3	0.10	3	00.7	3	00.4	2		00.0	3	00.3	3	00.6	4	0.10	4	0.14	4	0.18	3	0.21
3	0.26	5	0.21	5	0.16	5	0.11	6	00.5	3		00.0	5	00.5	6	0.11	6	0.17	6	0.23	6	0.29	5	0.34
4	0.38	7	0.31	7	0.24	8	0.16	8	00.8	4		00.0	8	00.8	9	0.17	9	0.26	9	0.35	9	0.44	7	0.51
5	0.57	11	0.46	11	0.35	11	0.24	12	0.12	5		00.1	12	0.13	12	0.25	12	0.37	12	0.49	20	1.09	12	1.21
6	1.29	15	1.14	15	0.59	15	0.44	19	0.19	6		00.2	18	0.20	18	0.38	18	0.56	18	1.14	53	2.07	33	2.40
7	2.38	30	2.08	30	1.38	30	1.08	30	0.38	7		00.3												
N E	5.22	46	4.36	46	3.50	47	3.03	47	2.16															

6 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.0192346	9.9976143	9.0216202	10.9783798	10.0023857	10.9807654	60
1	9.0204348	9.9976011	9.0228338	10.9771662	10.0023989	10.9795652	59
2	9.0216318	9.9975877	9.0240441	10.9759559	10.0024123	10.9783682	58
3	9.0228254	9.9975743	9.0252510	10.9747490	10.0024257	10.9771746	57
4	9.0240157	9.9975609	9.0264548	10.9735452	10.0024391	10.9759843	56
5	9.0252027	9.9975475	9.0276552	10.9723448	10.0024525	10.9747973	55
6	9.0263865	9.9975340	9.0288524	10.9711476	10.0024660	10.9736135	54
7	9.0275669	9.9975205	9.0300464	10.9699536	10.0024795	10.9724331	53
8	9.0287442	9.9975069	9.0312373	10.9687627	10.0024931	10.9712558	52
9	9.0299182	9.9974933	9.0324249	10.9675751	10.0025067	10.9700818	51
10	9.0310890	9.9974797	9.0336093	10.9663907	10.0025203	10.9689110	50
11	9.0322567	9.9974660	9.0347906	10.9652094	10.0025340	10.9677433	49
12	9.0334212	9.9974523	9.0359688	10.9640312	10.0025477	10.9665788	48
13	9.0345825	9.9974386	9.0371439	10.9628561	10.0025614	10.9654175	47
14	9.0357407	9.9974248	9.0383159	10.9616841	10.0025752	10.9642593	46
15	9.0368958	9.9974110	9.0394848	10.9605152	10.0025890	10.9631042	45
16	9.0380477	9.9973971	9.0406506	10.9593494	10.0026029	10.9619523	44
17	9.0391966	9.9973833	9.0418134	10.9581866	10.0026167	10.9608034	43
18	9.0403424	9.9973693	9.0429731	10.9570269	10.0026307	10.9596576	42
19	9.0414852	9.9973554	9.0441299	10.9558701	10.0026446	10.9585148	41
20	9.0426249	9.9973414	9.0452836	10.9547164	10.0026586	10.9573751	40
21	9.0437617	9.9973273	9.0464343	10.9535657	10.0026727	10.9562383	39
22	9.0448954	9.9973132	9.0475821	10.9524179	10.0026868	10.9551046	38
23	9.0460261	9.9972991	9.0487270	10.9512730	10.0027009	10.9539739	37
24	9.0471538	9.9972850	9.0498689	10.9501311	10.0027150	10.9528462	36
25	9.0482786	9.9972708	9.0510078	10.9489922	10.0027292	10.9517214	35
26	9.0494005	9.9972566	9.0521439	10.9478561	10.0027434	10.9505995	34
27	9.0505194	9.9972423	9.0532771	10.9467229	10.0027577	10.9494806	33
28	9.0516354	9.9972280	9.0544074	10.9455926	10.0027720	10.9483646	32
29	9.0527485	9.9972137	9.0555349	10.9444651	10.0027863	10.9472515	31
30	9.0538588	9.9971993	9.0566595	10.9433405	10.0028007	10.9461412	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

83 DEGREES.

Latitude 12 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	00.9	1	0.10	1	0.11	2	0.13	2	0.15	2	0.17	1	0.18	1	0.19	2	0.21	2	0.23	2	0.25	2	0.27	2	0.29
2	0.20	3	0.23	3	0.26	3	0.29	3	0.32	4	0.36	3	0.39	3	0.42	3	0.45	4	0.49	4	0.53	4	0.57	3	1.00
3	0.32	5	0.37	5	0.42	5	0.47	5	0.52	6	0.58	5	1.03	5	1.08	8	1.16	8	1.24	8	1.26	6	1.32	5	1.37
4	0.47	7	0.54	8	1.02	8	1.10	8	1.18	8	1.26	8	1.34	8	1.42	8	1.50	9	1.59	9	2.08	10	2.18	7	2.25
5	1.09	11	1.20	11	1.31	11	1.42	12	1.54	12	2.06	13	2.19	13	2.32	13	2.45	13	2.58	13	3.11	16	3.27	12	3.39
6	1.47	17	2.04	17	2.21	17	2.38	19	2.56	18	3.14	22	3.36	22	3.58	23	4.21	23	4.41	23	5.07	34	5.41		
7	3.05	29	2.34	29	4.03	29	4.32	30	5.02	30	5.32														
N E	6.00																								

6 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	1132032	9935718	1139356	87768874	10064697	88336715	30
31	1134922	9935388	1142303	87542461	10065031	88111761	29
32	1137812	9935058	1145250	87317198	10065366	87887957	28
33	1140702	9934727	1148197	87093077	10065702	87665295	27
34	1143592	9934395	1151144	86870088	10066039	87443766	26
35	1146482	9934062	1154091	86648223	10066377	87223361	25
36	1149371	9933728	1157039	86427475	10066715	87004071	24
37	1152261	9933393	1159987	86207833	10067054	86785889	23
38	1155151	9933057	1162935	85989290	10067394	86568805	22
39	1158040	9932720	1165883	85771838	10067735	86352812	21
40	1160929	9932383	1168831	85555468	10068077	86137901	20
41	1163818	9932045	1171780	85340172	10068420	85924065	19
42	1166707	9931706	1174729	85125943	10068764	85711295	18
43	1169596	9931366	1177678	84912772	10069108	85499584	17
44	1172485	9931025	1180628	84700651	10069453	85288923	16
45	1175374	9930684	1183578	84489573	10069799	85079304	15
46	1178263	9930342	1186528	84279531	10070146	84870721	14
47	1181151	9929999	1189478	84070515	10070494	84663165	13
48	1184040	9929655	1192428	83862519	10070843	84456629	12
49	1186928	9929310	1195378	83655536	10071193	84251105	11
50	1189816	9928964	1198328	83449557	10071544	84046586	10
51	1192704	9928617	1201279	83244577	10071896	83843065	9
52	1195593	9928270	1204230	83040586	10072248	83640534	8
53	1198481	9927922	1207181	82837579	10072601	83438986	7
54	1201368	9927573	1210132	82635547	10072955	83238415	6
55	1204256	9927223	1213084	82434485	10073310	83038812	5
56	1207144	9926872	1216036	82234384	10073666	82840171	4
57	1210031	9926521	1218988	82035239	10074023	82642485	3
58	1212919	9926169	1221940	81837041	10074381	82445748	2
59	1215806	9925816	1224893	81639786	10074740	82249952	1
60	1218693	9925462	1227846	81443464	10075099	82055090	0
	N. Co-Sine.	N. Sine.	N.Co-Tang	N. Tangent.	N.Co-Secant.	N. Secant.	M

83 DEGREES.

Latitude 13 Deg. 00 Min. North Declination.

	2	d.	4	d.	6	d	8	d.	10	d.	12			d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.			m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		N S		12.0		12.0		12.0		12.0		12.0		12.0
1	00.8	1	00.7	1	00.6	2	00.4	2	00.2	2	00.0		1		00.1	1	00.2	2	00.4	2	00.6	2	00.8	1	00.9
2	0.17	3	0.14	3	0.11	3	00.8	3	00.5	3	00.2		2		00.2	2	00.4	4	00.8	4	0.12	4	0.16	3	0.19
3	0.29	5	0.24	5	0.19	5	0.14	6	00.8	6	00.2		3		00.5	4	00.9	6	0.15	6	0.21	6	0.27	4	0.31
4	0.42	7	0.35	7	0.28	8	0.20	8	0.12	8	00.4		4		00.7	5	0.12	8	0.20	10	0.30	10	0.40	7	0.47
5	1.03	11	0.52	11	0.41	11	0.30	12	0.18	12	00.6		5		00.9	10	0.19	13	0.32	14	0.46	15	1.01	12	1.13
6	1.36	17	1.19	17	1.02	17	0.45	17	0.28	17	0.11		6		0.11	12	0.23	28	0.51	30	1.21	31	1.52	30	2.22
7	2.45	27	2.18	28	1.50	28	1.22	28	0.54	28	0.26		7		0.35										
N E	5.21	40	4.41	40	4.01	40	3.21	40	2.41	40	2.01														

6 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.0538588	9.9971993	9.0566595	10.9433405	10.0028007	10.9461412	30
31	9.0549661	9.9971849	9.0577813	10.9422187	10.0028151	10.9450339	29
32	9.0560706	9.9971704	9.0589002	10.9410998	10.0028296	10.9439294	28
33	9.0571723	9.9971559	9.0600164	10.9399836	10.0028441	10.9428377	27
34	9.0582711	9.9971414	9.0611297	10.9388703	10.0028586	10.9417289	26
35	9.0593672	9.9971268	9.0622403	10.9377597	10.0028732	10.9406328	25
36	9.0604604	9.9971122	9.0633482	10.9366518	10.0028878	10.9395496	24
37	9.0615509	9.9970976	9.0644533	10.9355467	10.0029024	10.9384491	23
38	9.0626386	9.9970829	9.0655556	10.9344444	10.0029171	10.9373614	22
39	9.0637235	9.9970682	9.0666553	10.9333447	10.0029318	10.9362765	21
40	9.0648057	9.9970535	9.0677522	10.9322478	10.0029465	10.9351943	20
41	9.0658852	9.9970387	9.0688465	10.9311535	10.0029613	10.9341148	19
42	9.0669619	9.9970239	9.0699381	10.9300619	10.0029761	10.9330381	18
43	9.0680360	9.9970090	9.0710270	10.9289730	10.0029910	10.9319640	17
44	9.0691074	9.9969941	9.0721133	10.9278867	10.0030059	10.9308926	16
45	9.0701761	9.9969792	9.0731969	10.9268031	10.0030208	10.9298239	15
46	9.0712421	9.9969642	9.0742779	10.9257221	10.0030358	10.9287579	14
47	9.0723055	9.9969492	9.0753563	10.9246437	10.0030508	10.9276945	13
48	9.0733663	9.9969342	9.0764321	10.9235679	10.0030658	10.9266337	12
49	9.0744244	9.9969191	9.0775053	10.9224947	10.0030809	10.9255756	11
50	9.0754799	9.9969040	9.0785760	10.9214240	10.0030960	10.9245201	10
51	9.0765329	9.9968888	9.0796441	10.9203559	10.0031112	10.9234671	9
52	9.0775832	9.9968736	9.0807096	10.9192904	10.0031264	10.9224168	8
53	9.0786310	9.9968584	9.0817726	10.9182274	10.0031416	10.9213690	7
54	9.0796762	9.9968431	9.0828331	10.9171669	10.0031569	10.9203238	6
55	9.0807189	9.9968278	9.0838911	10.9161089	10.0031722	10.9192811	5
56	9.0817590	9.9968125	9.0849466	10.9150534	10.0031875	10.9182410	4
57	9.0827966	9.9967971	9.0859996	10.9140004	10.0032029	10.9172034	3
58	9.0838317	9.9967817	9.0870501	10.9129499	10.0032183	10.9161683	2
59	9.0848643	9.9967662	9.0880981	10.9119019	10.0032338	10.9151357	1
60	9.0858945	9.9967507	9.0891438	10.9108562	10.0032493	10.9141055	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

83 DEGREES.

Latitude 13 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.10	1	0.11	1	0.12	2	0.14	2	0.16	2	0.18	1	0.19	1	0.20	2	0.22	2	0.24	2	0.26	2	0.28	1	0.29
2	0.21	3	0.24	3	0.27	3	0.30	4	0.34	4	0.38	3	0.41	3	0.44	3	0.47	4	0.51	4	0.55	4	0.59	3	1.02
3	0.34	5	0.39	5	0.44	5	0.49	5	0.54	6	1.00	5	1.05	5	1.10	6	1.16	6	1.22	6	1.28	6	1.34	5	1.39
4	0.51	7	0.58	7	1.05	8	1.13	8	1.21	8	1.29	8	1.37	8	1.45	9	1.54	9	2.03	9	2.12	9	2.21	8	2.29
5	1.14	11	1.25	11	1.36	11	1.47	12	1.59	12	2.11	12	2.23	13	2.36	13	2.49	13	3.02	13	3.15	15	3.30	12	3.42
6	1.54	17	2.11	17	2.28	17	2.45	17	3.02	18	3.20	21	2.41	22	4.03	22	4.25	22	4.47	22	5.09	31	5.40		
7	3.14	28	3.42	28	4.10	28	4.38	29	5.06	28	5.34														
N E	6.00																								

7 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	1218693	9925462	1227846	81443464	10075099	82055090	60
1	1221581	9925107	1230799	81248071	10075459	81861157	59
2	1224468	9924751	1233752	81053599	10075820	81668145	58
3	1227355	9924394	1236705	80860042	10076182	81476048	57
4	1230241	9924036	1239658	80667394	10076545	81284860	56
5	1233128	9923678	1242612	80475647	10076909	81094573	55
6	1236015	9923319	1245566	80284796	10077274	80905182	54
7	1238901	9922959	1248520	80094835	10077639	80716681	53
8	1241788	9922598	1251474	79905756	10078005	80529062	52
9	1244674	9922236	1254429	79717555	10078372	80342321	51
10	1247560	9921874	1257384	79530224	10078740	80156450	50
11	1250446	9921511	1260339	79343758	10079109	79971445	49
12	1253332	9921147	1263294	79158151	10079479	79787298	48
13	1256218	9920782	1266249	78973396	10079850	79604003	47
14	1259104	9920416	1269205	78789489	10080222	79421556	46
15	1261990	9920049	1272161	78606423	10080595	79239950	45
16	1264875	9919681	1275117	78424191	10080969	79059179	44
17	1267761	9919313	1278073	78242790	10081343	78879238	43
18	1270646	9918944	1281029	78062212	10081718	78700120	42
19	1273531	9918574	1283986	77882453	10082094	78521821	41
20	1276416	9918203	1286943	77703506	10082471	78344335	40
21	1279301	9917831	1289900	77525366	10082849	78167656	39
22	1282186	9917459	1292857	77348028	10083228	77991778	38
23	1285071	9917086	1295815	77171486	10083607	77816697	37
24	1287956	9916712	1298773	76995735	10083988	77642406	36
25	1290841	9916337	1301731	76820769	10084370	77468901	35
26	1293725	9915961	1304689	76646584	10084752	77296176	34
27	1296609	9915584	1307648	76473174	10085135	77124227	33
28	1299494	9915206	1310607	76300533	10085519	76953047	32
29	1302378	9914828	1313566	76128657	10085904	76782531	31
30	1305262	9914449	1316525	75957541	10086290	76612976	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

82 DEGREES.

Latitude 14 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d.	8	d.	10	d.	12			d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.			m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		N S		12.0		12.0		12.0		12.0		12.0		12.0
1	0.09	1	00.8	1	00.7	2	00.5	2	00.3	2	00.1		1		00.0	2	00.2	2	00.4	1	00.5	2	00.7	1	00.8
2	0.19	3	0.16	3	0.13	3	0.10	3	00.7	3	00.4		2		00.0	3	00.3	3	00.6	4	0.10	4	0.14	3	0.17
3	0.31	5	0.26	5	0.21	5	0.16	5	0.11	5	00.6		3		00.1	5	00.6	5	0.11	6	0.17	6	0.23	5	0.28
4	0.46	7	0.39	7	0.32	8	0.24	8	0.16	8	00.8		4		00.2	6	00.8	9	0.17	9	0.26	9	0.35	8	0.43
5	1.08	11	0.57	11	0.46	11	0.35	11	0.24	11	0.13		5		00.3	9	0.12	14	0.26	14	0.40	14	0.54	12	1.06
6	1.44	16	1.28	16	1.12	17	0.55	17	0.38	17	0.21		6		00.5	12	0.17	21	0.38	30	1.08	30	1.38	27	2.05
7	2.56	26	2.30	26	2.04	27	1.37	27	1.10	27	0.43		7		00.5	51	0.56	1.9	2.05						
N E	5.25	36	4.49	36	4.13	36	3.37	37	3.00	37	2.23														

7 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.0858945	9.9967507	9.0891438	10.9108562	10.0032493	10.9141055	60
1	9.0869221	9.9967352	9.0901869	10.9098131	10.0032648	10.9130779	59
2	9.0879473	9.9967196	9.0912277	10.9087723	10.0032804	10.9120527	58
3	9.0889700	9.9967040	9.0922660	10.9077340	10.0032960	10.9110300	57
4	9.0899903	9.9966884	9.0933020	10.9066980	10.0033116	10.9100097	56
5	9.0910082	9.9966727	9.0943355	10.9056645	10.0033273	10.9089918	55
6	9.0920237	9.9966570	9.0953669	10.9046333	10.0033430	10.9079763	54
7	9.0930367	9.9966412	9.0963955	10.9036045	10.0033588	10.9069633	53
8	9.0940474	9.9966254	9.0974219	10.9025781	10.0033746	10.9059526	52
9	9.0950556	9.9966096	9.0984460	10.9015540	10.0033904	10.9049444	51
10	9.0960615	9.9965937	9.0994678	10.9005322	10.0034063	10.9039385	50
11	9.0970651	9.9965778	9.1004872	10.8995128	10.0034222	10.9029349	49
12	9.0980662	9.9965619	9.1015044	10.8984956	10.0034381	10.9019338	48
13	9.0990651	9.9965459	9.1025192	10.8974808	10.0034541	10.9009349	47
14	9.1000616	9.9965299	9.1035317	10.8964683	10.0034701	10.8999384	46
15	9.1010558	9.9965138	9.1045420	10.8954580	10.0034862	10.8989442	45
16	9.1020477	9.9964977	9.1055500	10.8944500	10.0035023	10.8979523	44
17	9.1030373	9.9964816	9.1065557	10.8934443	10.0035184	10.8969627	43
18	9.1040246	9.9964655	9.1075591	10.8924409	10.0035345	10.8959754	42
19	9.1050096	9.9964493	9.1085604	10.8914396	10.0035507	10.8949904	41
20	9.1059924	9.9964330	9.1095594	10.8904406	10.0035670	10.8940076	40
21	9.1069729	9.9964167	9.1105562	10.8894438	10.0035833	10.8930271	39
22	9.1079512	9.9964004	9.1115508	10.8884492	10.0035996	10.8920488	38
23	9.1089272	9.9963841	9.1125431	10.8874569	10.0036159	10.8910728	37
24	9.1099010	9.9963677	9.1135333	10.8864667	10.0036323	10.8900990	36
25	9.1108726	9.9963513	9.1145213	10.8854787	10.0036487	10.8891274	35
26	9.1118420	9.9963348	9.1155072	10.8844928	10.0036652	10.8881580	34
27	9.1128092	9.9963183	9.1164909	10.8835091	10.0036817	10.8871908	33
28	9.1137742	9.9963018	9.1174724	10.8825276	10.0036982	10.8862258	32
29	9.1147370	9.9962852	9.1184518	10.8815482	10.0037148	10.8852630	31
30	9.1156977	9.9962686	9.1194291	10.8805709	10.0037314	10.8843023	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

82 DEGREES.

Latitude 14 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.11	1	0.12	1	0.13	2	0.15	2	0.17	2	0.19	1	0.20	1	0.21	2	0.23	2	0.25	2	0.27	2	0.29	1	0.30
2	0.23	3	0.26	3	0.29	3	0.32	4	0.36	4	0.40	3	0.43	3	0.46	3	0.49	4	0.53	4	0.57	4	1.01	3	1.04
3	0.37	5	0.42	5	0.47	5	0.52	5	0.57	6	1.03	5	1.08	5	1.13	6	1.19	6	1.25	6	1.31	5	1.36	6	1.42
4	0.54	7	1.01	8	1.09	8	1.17	8	1.25	8	1.33	8	1.41	8	1.49	8	1.57	9	2.06	9	2.15	9	2.24	7	2.31
5	1.20	11	1.31	11	1.42	11	1.53	11	2.04	11	2.15	12	2.27	13	2.40	13	2.53	13	3.06	13	3.19	14	3.33	12	3.45
6	2.01	16	1.13	17	1.34	17	1.51	17	2.08	17	3.25	21	3.46	21	4.07	21	4.28	21	4.49	22	5.11	29	5.40		
7	3.22	26	3.48	26	4.14	27	4.41	27	5.08	27	5.35														
N E	6.00																								

7 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	1305262	9914449	1316525	75957541	10086290	76612976	30
31	1308146	9914069	1319484	75787179	10086677	76444075	29
32	1311030	9913688	1322444	75617567	10087065	76275923	28
33	1313913	9913306	1325404	75448699	10087453	76108516	27
34	1316797	9912923	1328364	75280571	10087842	75941849	26
35	1319681	9912539	1331324	75113178	10088232	75775916	25
36	1322564	9912155	1334285	74946514	10088623	75610713	24
37	1325447	9911770	1337246	74780576	10089015	75446236	23
38	1328330	9911384	1340207	74615357	10089408	75282478	22
39	1331213	9910997	1343168	74450855	10089802	75119437	21
40	1334096	9910609	1346129	74287064	10090197	74957106	20
41	1336979	9910221	1349091	74123978	10090592	74797482	19
42	1339862	9909832	1352053	73961595	10090988	74634560	18
43	1342744	9909442	1355015	73799909	10091385	74474335	17
44	1345627	9909051	1357977	73638916	10091783	74314803	16
45	1348509	9908659	1360940	73478610	10092182	74155959	15
46	1351392	9908266	1363903	73318989	10092582	73997798	14
47	1354274	9907872	1366866	73160047	10092983	73840318	13
48	1357156	9907478	1369829	73001780	10093385	73683512	12
49	1360038	9907083	1372793	72844184	10093788	73527377	11
50	1362919	9906687	1375757	72687255	10094192	73371909	10
51	1365801	9906290	1378721	72530987	10094596	73217102	9
52	1368683	9905892	1381685	72375378	10095001	73062954	8
53	1371564	9905493	1384650	72220422	10095407	72909460	7
54	1374445	9905094	1387615	72066116	10095814	72756616	6
55	1377327	9904694	1390580	71912456	10096222	72604417	5
56	1380208	9904293	1393545	71759437	10096631	72452859	4
57	1383089	9903891	1396510	71607056	10097041	72301940	3
58	1385970	9903488	1399476	71455308	10097452	72151653	2
59	1388850	9903084	1302442	71304190	10097864	72001996	1
60	1391731	9902680	1305408	71153697	10098276	71852965	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

82 DEGREES.

Latitude 15 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d.	8	d.	10	d.	12			d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.			m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		N S		12.0		12.0		12.0		12.0		12.0		12.0
1	0.10	1	00.9	1	00.8	2	00.6	2	00.4	3	00.1		1		Zenith.		00.1	1	00.2	2	00.4	2	00.6	1	00.7
2	0.21	3	0.18	3	0.15	3	0.12	4	00.8	6	00.2		2				00.3	3	00.6	3	00.9	3	0.12	3	0.15
3	0.34	5	0.29	5	0.24	5	0.19	6	0.13	10	00.3		3				00.4	4	00.8	6	0.14	6	0.20	5	0.25
4	0.50	7	0.43	7	0.36	8	0.25	8	0.20	15	00.5		4				00.5	8	0.13	9	0.22	9	0.31	7	0.38
5	1.13	10	1.03	11	0.52	11	0.41	11	0.30	29	0.11		5				00.8	11	0.19	14	0.33	14	0.47	12	0.59
6	1.43	14	1.29	14	1.15	14	1.01	14	0.47	30	0.17		6				0.15	13	0.28	28	0.56	28	1.24	26	1.50
7	3.04	25	2.39	25	2.14	25	1.49	25	1.24	47	0.37		7				0.55	14	1.09						
NE	5.27	33	4.54	33	4.21	33	3.48	33	3.15	112	2.03		8												

7 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.1156977	9.9962686	9.1194291	10.8805709	10.0037314	10.8843023	30
31	9.1166562	9.9962519	9.1204043	10.8795957	10.0037481	10.8833438	29
32	9.1176125	9.9962352	9.1213773	10.8786227	10.0037648	10.8823875	28
33	9.1185667	9.9962185	9.1223482	10.8776518	10.0037815	10.8814333	27
34	9.1195188	9.9962017	9.1233171	10.8766829	10.0037983	10.8804812	26
35	9.1204688	9.9961849	9.1242839	10.8757161	10.0038151	10.8795312	25
36	9.1214167	9.9961681	9.1252486	10.8747514	10.0038319	10.8785833	24
37	9.1223624	9.9961512	9.1262112	10.8737888	10.0038488	10.8776376	23
38	9.1233061	9.9961343	9.1271718	10.8728282	10.0038657	10.8766939	22
39	9.1242477	9.9961174	9.1281303	10.8718697	10.0038826	10.8757523	21
40	9.1251872	9.9961004	9.1290868	10.8709132	10.0038996	10.8748128	20
41	9.1261246	9.9960834	9.1300413	10.8699587	10.0039166	10.8738754	19
42	9.1270600	9.9960663	9.1309937	10.8690063	10.0039337	10.8729490	18
43	9.1279934	9.9960492	9.1319442	10.8680558	10.0039508	10.8720066	17
44	9.1289247	9.9960321	9.1328926	10.8671074	10.0039697	10.8710753	16
45	9.1298539	9.9960149	9.1338391	10.8661609	10.0039851	10.8701461	15
46	9.1307812	9.9959977	9.1347835	10.8652165	10.0040023	10.8692188	14
47	9.1317064	9.9959804	9.1357260	10.8642740	10.0040196	10.8682936	13
48	9.1326297	9.9959631	9.1366665	10.8633335	10.0040369	10.8673703	12
49	9.1335509	9.9959458	9.1376051	10.8623949	10.0040542	10.8664491	11
50	9.1344702	9.9959284	9.1385417	10.8614583	10.0040716	10.8655298	10
51	9.1353875	9.9959111	9.1394764	10.8605236	10.0040889	10.8646125	9
52	9.1363028	9.9958936	9.1404092	10.8595908	10.0041064	10.8636972	8
53	9.1372161	9.9958761	9.1413400	10.8586600	10.0041239	10.8627839	7
54	9.1381275	9.9958586	9.1422689	10.8577311	10.0041414	10.8618725	6
55	9.1390370	9.9958411	9.1431959	10.8568041	10.0041589	10.8609630	5
56	9.1399445	9.9958235	9.1441210	10.8558790	10.0041765	10.8600555	4
57	9.1408501	9.9958059	9.1450442	10.8549558	10.0041941	10.8591499	3
58	9.1417537	9.9957882	9.1459655	10.8540345	10.0042118	10.8582463	2
59	9.1426555	9.9957705	9.1468850	10.8531150	10.0042295	10.8573445	1
60	9.1435553	9.9957528	9.1478025	10.8521975	10.0042472	10.8564447	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

82 DEGREES.

Latitude 15 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.12	1	0.13	1	0.14	2	0.16	2	0.18	2	0.20	1	0.21	1	[illegible]	2	0.24	2	0.26	2	0.28	2	0.30	1	0.31
2	0.24	3	0.27	3	0.30	3	0.33	3	0.36	4	0.40	3	0.43	3	[illegible]	4	0.50	4	0.54	4	0.58	3	1.01	3	1.04
3	0.39	5	0.44	5	0.49	5	0.54	5	0.59	6	1.05	5	1.10	5	1.15	6	1.21	6	1.27	6	1.33	6	1.39	4	1.43
4	0.58	7	1.05	7	1.12	8	1.20	8	1.28	8	1.36	8	1.44	8	[illegible]	8	2.00	9	2.09	9	2.18	9	2.27	7	2.34
5	1.25	12	1.37	13	1.50	13	2.03	13	2.16	13	2.29	10	2.39	10	2.49	11	3.00	11	3.11	11	3.22	15	3.37	9	3.48
6	2.08	16	2.24	16	2.40	16	2.56	16	3.12	17	3.29	20	3.49	20	4.09	21	4.30	21	4.51	21	5.12	28	5.40		
7	3.30	25	3.55	25	3.20	25	3.45	25	4.10	26	5.36														
NE	6.00																								

8 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	1391731	9902680	1405408	71153697	10098276	71852965	60
1	1394612	9902275	1408374	71003826	10098689	71704556	59
2	1397492	9901869	1411341	70854573	10099103	71556764	58
3	1400372	9901462	1414308	70705934	10099518	71409587	57
4	1403252	9901054	1417275	70557905	10099934	71263019	56
5	1406132	9900645	1420243	70410482	10100351	71117058	55
6	1409012	9900236	1423211	70263662	10100769	70971700	54
7	1411892	9899826	1426179	70117441	10101188	70826941	53
8	1414772	9899415	1429147	69971806	10101607	70682777	52
9	1417651	9899003	1432115	69826781	10102027	70539205	51
10	1420531	9898590	1435084	69682335	10102448	70396220	50
11	1423410	9898176	1438053	69538473	10102870	70253820	49
12	1426289	9897762	1441022	69395192	10103293	70112001	48
13	1429168	9897347	1443991	69252489	10103717	69970760	47
14	1432047	9896931	1446961	69110359	10104142	69830092	46
15	1434926	9896514	1449931	68968799	10104568	69689994	45
16	1437805	9896096	1452901	68827807	10104995	69550464	44
17	1440684	9895677	1455871	68687378	10105423	69411496	43
18	1443562	9895257	1458842	68547508	10105851	69273089	42
19	1446440	9894837	1461813	68408196	10106280	69135239	41
20	1449319	9894416	1464784	68269437	10106710	68997942	40
21	1452197	9893994	1467755	68131227	10107141	68861195	39
22	1455075	9893571	1470727	67993565	10107573	68724995	38
23	1457953	9893147	1473699	67856446	10108006	68589338	37
24	1460830	9892723	1476671	67719867	10108440	68454222	36
25	1463708	9892298	1479644	67583826	10108875	68319642	35
26	1466585	9891872	1482617	67448319	10109311	68185597	34
27	1469463	9891445	1485590	67313341	10109747	68052082	33
28	1472340	9891017	1488563	67178891	10110184	67919095	32
29	1475217	9890588	1491536	67044966	10110622	67786632	31
30	1478094	9890158	1494510	66911562	10111061	67654691	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

81 DEGREES.

Latitude 16 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16			d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.			m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		N S		12.0		12.0		12.0		12.0
1	0.11	1	0.10	1	00.9	2	00.7	2	00.5	1	00.4	1	00.3	2	00.1		1		00.1	2	00.3	2	00.5	2	00.7
2	0.22	3	0.19	3	0.16	3	0.13	3	0.10	2	[illegible]	3	00.5	3	00.2		2		00.3	4	00.7	4	0.11		0.14
3	0.36	5	0.31	5	0.26	5	0.21	5	0.16	4	0.12	5	00.7	5	00.2		3		00.5	6	0.11	6	0.17		0.22
4	0.53	7	0.46	7	0.39	7	0.32	7	0.25	7	0.18	7	0.11	8	00.3		4		00.8	9	0.17	9	0.26	7	0.33
5	1.18	10	1.08	11	0.57	11	0.46	11	0.35	10	0.25	10	0.15	11	00.4		5		0.12	14	0.26	14	0.40	12	0.52
6	1.57	15	1.42	15	1.27	16	1.11	16	0.55	16	0.39	16	0.23	16	00.7		6		0.17	27	0.44	27	1.11	23	1.34
7	3.11	23	2.48	23	2.25	24	2.01	24	1.37	27	1.10	27	0.33	27	0.16		7		0.38						
N E	5.29	30	4.59	30	4.29	30	3.59	31	3.28	43	2.45	43	2.02	44	1.18										

8 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.1435553	9.9957528	9.1478025	10.8521975	10.0042472	10.8564447	60
1	9.1444532	9.9957350	9.1487182	10.8512818	10.0042650	10.8555468	59
2	9.1453493	9.9957172	9.1496321	10.8503679	10.0042828	10.8546507	58
3	9.1462435	9.9956993	9.1505441	10.8494559	10.0043007	10.8537565	57
4	9.1471358	9.9956815	9.1514543	10.8485457	10.0043185	10.8528642	56
5	9.1480262	9.9956635	9.1523627	10.8476373	10.0043365	10.8519738	55
6	9.1489148	9.9956456	9.1532692	10.8467308	10.0043544	10.8510852	54
7	9.1498015	9.9956276	9.1541739	10.8458261	10.0043724	10.8501985	53
8	9.1506864	9.9956095	9.1550769	10.8449231	10.0043905	10.8493136	52
9	9.1515694	9.9955915	9.1559780	10.8440220	10.0044085	10.8484306	51
10	9.1524507	9.9955734	9.1568773	10.8431227	10.0044266	10.8475493	50
11	9.1533301	9.9955552	9.1577748	10.8422252	10.0044448	10.8466699	49
12	9.1542076	9.9955370	9.1586706	10.8413294	10.0044630	10.8457924	48
13	9.1550834	9.9955188	9.1595646	10.8404354	10.0044812	10.8449166	47
14	9.1559574	9.9955005	9.1604569	10.8395431	10.0044995	10.8440426	46
15	9.1568296	9.9954822	9.1613473	10.8386527	10.0045178	10.8431704	45
16	9.1577000	9.9954639	9.1622361	10.8377639	10.0045361	10.8423000	44
17	9.1585686	9.9954455	9.1631231	10.8368769	10.0045545	10.8414314	43
18	9.1594354	9.9954272	9.1640083	10.8359917	10.0045729	10.8405646	42
19	9.1603005	9.9954087	9.1648919	10.8351081	10.0045913	10.8396995	41
20	9.1611639	9.9953902	9.1657737	10.8342263	10.0046098	10.8388361	40
21	9.1620254	9.9953717	9.1666538	10.8333462	10.0046283	10.8379745	39
22	9.1628853	9.9953531	9.1675322	10.8324678	10.0046469	10.8371147	38
23	9.1637434	9.9953345	9.1684089	10.8315911	10.0046655	10.8362566	37
24	9.1645998	9.9953159	9.1692839	10.8307161	10.0046841	10.8354002	36
25	9.1654544	9.9952972	9.1701572	10.8298428	10.0047028	10.8345456	35
26	9.1663074	9.9952785	9.1710289	10.8289711	10.0047215	10.8336926	34
27	9.1671586	9.9952597	9.1718989	10.8281011	10.0047403	10.8328414	33
28	9.1680081	9.9952409	9.1727672	10.8272328	10.0047591	10.8319919	32
29	9.1688559	9.9952221	9.1736338	10.8263662	10.0047779	10.8311441	31
30	9.1697021	9.9952033	9.1744988	10.8255012	10.0047967	10.8302979	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

81 DEGREES.

Latitude 16 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.13	1	0.14	1	0.15	1	0.16	2	0.18	2	0.20	1	0.21	1	0.22	2	0.24	2	0.26	2	0.28	2	0.30		0.32
2	0.26	3	0.29	3	0.32	3	0.35	3	0.38	4	0.42	3	0.45	3	0.48	3	0.51	4	0.55	4	0.59	4	1.03		1.06
3	0.42	5	0.47	5	0.52	5	0.57	5	1.02	5	1.07	5	1.12	5	1.17	6	1.23	6	1.29	6	1.35	6	1.41		1.46
4	1.02	7	1.09	7	1.16	7	1.23	8	1.31	8	1.39	8	1.47	8	1.55	8	2.03	9	2.12	9	2.21	9	2.30		2.37
5	1.30	10	1.40	11	1.51	11	2.02	11	2.13	11	2.24	12	2.36	12	2.48	12	3.00	12	3.12	13	3.25	15	3.40		3.51
6	2.15	15	2.30	16	2.46	16	3.02	16	3.18	16	3.34	19	3.53	20	4.13	20	4.33	20	4.53	20	5.13	27	5.40		
7	3.37	23	4.00	24	4.24	24	4.48	24	5.12	24	5.36														
W E	6.00																								

8 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	1478094	9890158	1494510	66911562	10111061	67654691	30
31	1480971	9889728	1497484	66778677	10111501	67523268	29
32	1483848	9889297	1500458	66646307	10111942	67392360	28
33	1486724	9888865	1503433	66514449	10112384	67261965	27
34	1489601	9888432	1506408	66383100	10112827	67132079	26
35	1492477	9887998	1509383	66252258	10113271	67002699	25
36	1495353	9887563	1512358	66121919	10113715	66873822	24
37	1498230	9887128	1515333	65992080	10114160	66745446	23
38	1501106	9886692	1518309	65862739	10114606	66617568	22
39	1503981	9886255	1521285	65733892	10115053	66490184	21
40	1506857	9885817	1524261	65605538	10115501	66363293	20
41	1509733	9885378	1527238	65477672	10115950	66236890	19
42	1512608	9884938	1530215	65350293	10116400	66110973	18
43	1515484	9884498	1533192	65223396	10116851	65985540	17
44	1518359	9884057	1536169	65096981	10117303	65860587	16
45	1521234	9883615	1539147	64971043	10117756	65736112	15
46	1524109	9883172	1542125	64845581	10118209	65612113	14
47	1526984	9882728	1545103	64720591	10118663	65488586	13
48	1529858	9882283	1548082	64596070	10119118	65365528	12
49	1532733	9881838	1551061	64472017	10119574	65242938	11
50	1535607	9881392	1554040	64348428	10120031	65120812	10
51	1538482	9880945	1557019	64225301	10120489	64999148	9
52	1541356	9880497	1559998	64102633	10120948	64877944	8
53	1544230	9880048	1562978	63980422	10121408	64757195	7
54	1547104	9879598	1565958	63858665	10121869	64636901	6
55	1549978	9879148	1568938	63737359	10122331	64517059	5
56	1552851	9878697	1571919	63616502	10122793	64397666	4
57	1555725	9878245	1574900	63496092	10123256	64278719	3
58	1558598	9877792	1577881	63376126	10123720	64160216	2
59	1561472	9877338	1580862	63256601	10124185	64042154	1
60	1564345	9876883	1583844	63137515	10124651	63924532	0
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co-Secant.	N. Secant.	M

81 DEGREES.

Latitude 17 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16			d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.			m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		N S		12.0		12.0		12.0		12.0
1	0.11	1	0.10	1	00.9	1	00.8	2	00.6	1	00.5	1	00.4	2	00.2		1		00.0	2	00.2	2	00.4	2	00.6
2	0.24	3	0.21	3	0.18	3	0.15	3	0.12	3	00.9	3	00.6	4	00.2		2		00.1	4	00.5	4	00.9	3	0.12
3	0.39	5	0.34	5	0.29	5	0.24	5	0.19	4	0.15	5	0.10	[illegible]	00.5		3		00.1	7	00.8	7	0.15	4	0.19
4	0.58	7	0.51	7	0.44	8	0.36	8	0.28	7	0.21	7	0.14	8	00.6		4		00.4	9	0.13	9	0.22	7	0.29
5	1.24	10	1.14	11	1.03	11	0.52	11	0.41	10	0.31	10	0.21	11	0.10		5		00.5	14	0.19	14	0.33	12	0.45
6	2.05	15	1.50	15	1.35	16	1.19	16	1.03	15	0.48	16	0.32	16	0.16		6		00.8	25	0.33	25	0.58	22	1.20
7	3.20	22	2.58	23	2.35	23	2.12	23	1.49	25	1.24	25	0.59	26	0.33		7		0.15	1.21	1.36				
NE	5.31	28	5.03	28	4.35	28	4.07	28	3.39	36	3.03	36	2.27	36	1.51										
											5.58	25	5.33	26	5.07										

8 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.1697021	9.9952033	9.1744988	10.8255012	10.0047967	10.8302979	30
31	9.1705465	9.9951844	9.1753622	10.8246378	10.0048156	10.8294534	29
32	9.1713893	9.9951654	9.1762239	10.8237761	10.0048346	10.8286107	28
33	9.1722305	9.9951464	9.1770840	10.8229160	10.0048536	10.8277695	27
34	9.1730699	9.9951274	9.1779425	10.8220575	10.0048726	10.8269301	26
35	9.1739077	9.9951084	9.1787993	10.8212007	10.0048916	10.8260923	25
36	9.1747439	9.9950893	9.1796546	10.8203454	10.0049107	10.8252561	24
37	9.1755784	9.9950702	9.1805082	10.8194918	10.0049298	10.8244216	23
38	9.1764112	9.9950510	9.1813602	10.8186398	10.0049490	10.8235888	22
39	9.1772425	9.9950318	9.1822106	10.8177894	10.0049682	10.8227575	21
40	9.1780721	9.9950126	9.1830595	10.8169405	10.0049874	10.8219279	20
41	9.1789001	9.9949933	9.1839068	10.8160932	10.0050067	10.8210999	19
42	9.1797265	9.9949740	9.1847525	10.8152475	10.0050260	10.8202735	18
43	9.1805512	9.9949546	9.1855966	10.8144034	10.0050454	10.8194888	17
44	9.1813744	9.9949352	9.1864392	10.8135608	10.0050648	10.8186256	16
45	9.1821960	9.9949158	9.1872802	10.8127198	10.0050842	10.8178040	15
46	9.1830160	9.9948964	9.1881196	10.8118804	10.0051036	10.8169840	14
47	9.1838344	9.9948769	9.1889575	10.8110425	10.0051231	10.8161656	13
48	9.1846512	9.9948573	9.1897939	10.8102061	10.0051427	10.8153488	12
49	9.1854665	9.9948377	9.1906287	10.8093713	10.0051623	10.8145335	11
50	9.1862802	9.9948181	9.1914621	10.8085379	10.0051819	10.8137199	10
51	9.1870923	9.9947985	9.1922939	10.8077061	10.0052015	10.8129077	9
52	9.1879029	9.9947788	9.1931241	10.8068759	10.0052212	10.8120971	8
53	9.1887120	9.9947591	9.1939529	10.8060471	10.0052409	10.8112880	7
54	9.1895195	9.9947393	9.1947802	10.8052198	10.0052607	10.8104805	6
55	9.1903254	9.9947195	9.1956059	10.8043941	10.0052805	10.8096745	5
56	9.1911299	9.9946997	9.1964302	10.8035698	10.0053003	10.8088701	4
57	9.1919328	9.9946798	9.1972530	10.8027470	10.0053202	10.8080672	3
58	9.1927342	9.9946599	9.1980743	10.8019257	10.0053401	10.8072658	2
59	9.1935341	9.9946399	9.1988941	10.8011059	10.0053601	10.8064659	1
60	9.1943324	9.9946199	9.1997125	10.8002875	10.0053801	10.8056676	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

81 DEGREES.

Latitude 17 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.13	1	0.14	1	0.15	2	0.17	2	0.19	2	0.21	1	0.22	1	0.23	2	0.25	2	0.27	2	0.29	2	0.31	2	0.33
2	0.28	3	0.31	3	0.34	3	0.37	3	0.40	3	0.43	3	0.46	3	0.49	4	0.53	4	0.57	4	1.01	3	1.04	3	1.07
3	0.44	5	0.49	5	0.54	5	0.59	5	1.04	5	1.09	5	1.14	5	1.19	6	1.25	6	1.31	6	1.37	6	1.43	4	1.47
4	1.05	7	1.12	7	1.19	7	1.26	8	1.24	8	1.42	8	1.50	8	1.55	8	2.06	8	2.14	9	2.23	9	2.32	7	2.39
5	1.35	10	1.45	10	1.55	11	2.06	11	2.17	11	2.28	12	2.40	12	2.52	12	3.04	12	3.16	13	3.29	13	3.42	12	3.54
6	2.21	15	2.36	15	2.51	16	3.07	16	3.23	16	3.39	19	3.58	19	4.17	19	4.36	19	4.55	19	5.14	25	5.39		
7	3.43	22	4.05	23	4.28	23	4.51	23	5.14	23	5.37														
NE	6.00																								

9 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	1564345	9876883	1583844	63137515	10124651	63924532	60
1	1567218	9876428	1586826	63018866	10125118	63807347	59
2	1570091	9875972	1589808	62900651	10125586	63690595	58
3	1572963	9875515	1592791	62782868	10126055	63574276	57
4	1575836	9875057	1595774	62665514	10126525	63458386	56
5	1578708	9874598	1598757	62548588	10126996	63342923	55
6	1581581	9874138	1601740	62432086	10127467	63227884	54
7	1584453	9873677	1604724	62316007	10127939	63113269	53
8	1587325	9873216	1607708	62200347	10128412	62999073	52
9	1590197	9872754	1610692	62085106	10128886	62885295	51
10	1593069	9872291	1613677	61970279	10129361	62771933	50
11	1595940	9871827	1616662	61855867	10129837	62658984	49
12	1598812	9871362	1619647	61741865	10130314	62546446	48
13	1601683	9870897	1622632	61628272	10130792	62434316	47
14	1603555	9870431	1625617	61515085	10131271	62322594	46
15	1607426	9869964	1628603	61402303	10131751	62211275	45
16	1610297	9869496	1631589	61289923	10132231	62100359	44
17	1613167	9869027	1634576	61177943	10132712	61989843	43
18	1616038	9868557	1637563	61066360	10133194	61879725	42
19	1618909	9868086	1640550	60955174	10133677	61770003	41
20	1621779	9867615	1643537	60844381	10134161	61660674	40
21	1624650	9867143	1646525	60733979	10134646	61551736	39
22	1627520	9866670	1649513	60623967	10135132	61443189	38
23	1630390	9866196	1652501	60514343	10135619	61335028	37
24	1633260	9865721	1655489	60405103	10136107	612272[illegible]	36
25	1636129	9865246	1658478	60296247	10136595	61119861	35
26	1638999	9864770	1661467	60187772	10137084	61012850	34
27	1641868	9864293	1664456	60079676	10137574	60906219	33
28	1644738	9863815	1667446	59971957	10138065	60799964	32
29	1647607	9863336	1670436	59864614	10138557	60694085	31
30	1650476	9862856	1673426	59757644	10139050	60588580	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

80 DEGREES.

Latitude 18 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18			d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.			m	h. m.	m.	h. m.	m.	h. m.
S·N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		N		12.0		12.0		12.0
1	0.12	1	0.11	1	0.10	2	00.8	2	00.6	1	00.5	1	00.4	2	00.2	2	00.0		1		00.2	1	00.3	2	00.5
2	0.25	3	0.22	3	0.19	3	0.16	3	0.13	3	0.10	3	00.7	3	00.4	3	00.1		2		00.4	3	00.7	3	0.10
3	0.41	5	0.36	5	0.31	5	0.26	5	0.21	5	0.16	5	0.11	5	00.6	5	0.01		3		00.6	6	0.12	4	0.16
4	1.01	7	0.54	7	0.47	7	0.40	8	0.32	7	0.25	7	0.18	8	0.10	8	00.2		4		00.9	8	0.17	7	0.24
5	1.28	10	1.18	10	1.08	10	0.58	11	0.47	11	0.36	11	0.25	11	0.14	12	00.2		5		0.13	14	0.27	11	0.38
6	2.10	14	1.56	15	1.41	15	1.26	15	1.11	16	0.55	17	0.38	17	0.21	17	00.4		6		0.21	24	0.45	21	1.06
7	3.26	21	3.05	21	2.44	22	2.22	22	2.00	28	1.32	28	1.04	28	0.36	28	00.8		7		0.53				
WE	5.32	25	5.07	26	4.41	26	4.15	26	3.49	44	3.05	44	2.21	44	1.37	45	0.52								
1												43	5.53	43	5.10	43	4.27								

9 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.1943324	9.9946199	9.1997125	10.8002875	10.0053801	10.8056676	60
1	9.1951293	9.9945999	9.2005294	10.7994706	10.0054001	10.8048707	59
2	9.1959247	9.9945798	9.2013449	10.7986551	10.0054202	10.8040753	58
3	9.1967186	9.9945597	9.2021588	10.7978411	10.0054403	10.8032814	57
4	9.1975110	9.9945396	9.2029714	10.7970286	10.0054604	10.8024890	56
5	9.1983019	9.9945194	9.2037825	10.7962175	10.0054806	10.8016981	55
6	9.1990913	9.9944992	9.2045922	10.7954078	10.0055008	10.8009087	54
7	9.1998793	9.9944789	9.2054004	10.7945996	10.0055211	10.8001207	53
8	9.2006658	9.9944587	9.2062072	10.7937928	10.0055413	10.7993342	52
9	9.2014509	9.9944383	9.2070126	10.7929874	10.0055617	10.7985491	51
10	9.2022345	9.9944180	9.2078165	10.7921835	10.0055820	10.7977655	50
11	9.2030167	9.9943975	9.2086191	10.7913809	10.0056025	10.7969833	49
12	9.2037974	9.9943771	9.2094203	10.7905797	10.0056229	10.7962026	48
13	9.2045766	9.9943566	9.2102200	10.7897800	10.0056434	10.7954234	47
14	9.2053545	9.9943361	9.2110184	10.7889816	10.0056639	10.7946455	46
15	9.2061309	9.9943156	9.2118153	10.7881847	10.0056844	10.7938691	45
16	9.2069059	9.9942950	9.2126109	10.7873891	10.0057050	10.7930941	44
17	9.2076795	9.9942743	9.2134051	10.7865949	10.0057227	10.7923205	43
18	9.2084516	9.9942537	9.2141980	10.7858020	10.0057463	10.7915484	42
19	9.2092224	9.9942330	9.2149894	10.7850106	10.0057670	10.7907776	41
20	9.2099917	9.9942122	9.2157795	10.7842205	10.0057878	10.7900083	40
21	9.2107597	9.9941914	9.2165683	10.7834317	10.0058086	10.7892403	39
22	9.2115263	9.9941706	9.2173556	10.7826444	10.0058294	10.7884737	38
23	9.2122914	9.9941498	9.2181417	10.7818583	10.0058502	10.7877086	37
24	9.2130552	9.9941289	9.2189264	10.7810736	10.0058711	10.7869448	36
25	9.2138176	9.9941079	9.2197097	10.7802903	10.0058921	10.7861824	35
26	9.2145787	9.9940870	9.2204917	10.7795083	10.0059130	10.7854213	34
27	9.2153384	9.9940659	9.2212724	10.7787276	10.0059341	10.7846616	33
28	9.2160967	9.9940449	9.2220518	10.7779482	10.0059551	10.7839033	32
29	9.2168536	9.9940238	9.2228298	10.7771702	10.0059762	10.7831464	31
30	9.2176092	9.9940027	9.2236065	10.7763935	10.0059973	10.7823908	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

80 DEGREES.

Latitude 18 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.14	1	0.15	1	0.16	2	0.18	2	0.20	2	0.22	1	0.23	1	0.24	2	0.26	2	0.28	2	0.30	2	0.32	1	0.33
2	0.29	3	0.32	3	0.35	3	0.38	3	0.41	4	0.45	3	0.48	3	0.51	3	0.54	4	0.58	4	1.02	4	1.06	2	1.08
3	0.47	5	0.52	5	0.57	5	1.02	5	1.07	5	1.12	5	1.17	5	1.22	5	1.27	6	1.33	6	1.39	6	1.45	5	1.50
4	1.09	7	1.16	7	1.23	7	1.30	8	1.38	8	1.46	8	1.54	8	2.02	8	2.10	8	2.18	8	2.26	9	2.35	7	2.42
5	1.39	10	1.49	10	1.59	11	2.10	11	2.21	11	2.32	11	2.43	12	2.55	12	3.07	12	3.19	12	3.31	14	3.45	11	3.56
6	2.27	15	2.42	15	2.57	15	3.12	15	3.27	16	3.43	18	4.01	18	4.19	18	4.37	19	4.56	19	5.15	24	5.39		
7	3.49	21	4.10	22	4.32	22	4.54	22	5.16	22	5.38														
WE	6.00																								

9 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	1650476	9862856	1673426	59757644	10139050	60588580	30
31	1653345	9862375	1676416	59651045	10139544	60483445	29
32	1656214	9861894	1679407	59544815	10140039	60378680	28
33	1659082	9861412	1682398	59438952	10140535	60274282	27
34	1661951	9860929	1685389	59333455	10141032	60170250	26
35	1664819	9860445	1688381	59228322	10141530	60066581	25
36	1667687	9859960	1691373	59123550	10142029	59963274	24
37	1670555	9859474	1694365	59019138	10142529	59860326	23
38	1673423	9858988	1697358	58915084	10143029	59757737	22
39	1676291	9858501	1700351	58811386	10143530	59655504	21
40	1679159	9858013	1703344	58708042	10144032	59553625	20
41	1682026	9857524	1706337	58605051	10144535	59452098	19
42	1684894	9857034	1709331	58502410	10145039	59350922	18
43	1687761	9856544	1712325	58400117	10145544	59250095	17
44	1690628	9856053	1715319	58298172	10146050	59149614	16
45	1693495	9855561	1718314	58196572	10146557	59049479	15
46	1696362	9855068	1721309	58095315	10147064	58949688	14
47	1699228	9854574	1724304	57994400	10147572	58850238	13
48	1702095	9854079	1727300	57893825	10148081	58751128	12
49	1704961	9853583	1730296	57793588	10148591	58652356	11
50	1707828	9853087	1733292	57693688	10149102	58553920	10
51	1710694	9852590	1736288	57594122	10149614	58455820	9
52	1713560	9852092	1739285	57494889	10150127	58358053	8
53	1716425	9851593	1742282	57395988	10150641	58260617	7
54	1719291	9851093	1745279	57297416	10151156	58163510	6
55	1722156	9850592	1748277	57199173	10151672	58066732	5
56	1725022	9850091	1751275	57101256	10152189	57970280	4
57	1727887	9849589	1754273	57003663	10152707	57874153	3
58	1730752	9849086	1757272	56906394	10153226	57778350	2
59	1733617	9848582	1760271	56809446	10153746	57682867	1
60	1736482	9848077	1763270	56712818	10154267	57587705	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

80 DEGREES.

Latitude 19 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18			d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.			m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		N		12.0		12.0		12.0
1	0.13	1	0.12	1	0.11	2	00.9	2	00.7	1	00.6	1	00.5	2	00.3	2	00.1		1		00.1	2	00.3	1	00.4
2	0.27	3	0.24	3	0.21	3	0.18	3	0.15	3	0.12	3	00.9	3	00.6	3	00.3		2		00.2	3	00.5	[illegible]	00.8
3	0.43	4	0.39	5	0.34	5	0.29	5	0.24	5	0.19	5	0.14	5	00.9	5	00.4		3		00.3	6	00.9	4	0.13
4	1.04	7	0.57	7	0.50	7	0.43	7	0.36	7	0.29	7	0.22	8	0.14	8	00.6		4		00.4	9	0.13	7	0.20
5	1.36	11	1.25	11	1.14	11	1.03	11	0.52	11	0.41	11	0.30	11	0.19	11	00.8		5		00.6	14	0.20	11	0.31
6	2.17	14	2.03	14	1.47	15	1.34	15	1.19	16	1.03	16	1.47	17	1.30	17	0.13		6		0.10	23	0.33	20	0.53
7	3.31	20	3.11	20	2.51	21	2.31	21	2.09	25	1.44	26	1.18	26	0.52	26	0.26		7		0.23				
NE	5.32	23	5.09	24	4.45	24	4.21	24	3.57	36	3.21	36	2.45	37	2.08	37	1.31								
											5.56	26	5.30	26	5.03	27	4.36								

9 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.2176092	9.9940027	9.2236065	10.7763935	10.0059973	10.7823908	30
31	9.2183635	9.9939815	9.2243819	10.7756181	10.0060185	10.7816365	29
32	9.2191164	9.9939603	9.2251561	10.7748439	10.0060397	10.7808836	28
33	9.2198680	9.9939391	9.2259289	10.7740711	10.0060609	10.7801320	27
34	9.2206182	9.9939178	9.2267004	10.7732996	10.0060822	10.7793818	26
35	9.2213671	9.9938965	9.2274706	10.7725294	10.0061035	10.7786329	25
36	9.2221147	9.9938752	9.2282395	10.7717605	10.0061248	10.7778853	24
37	9.2228609	9.9938538	9.2290071	10.7709929	10.0061462	10.7771391	23
38	9.2236059	9.9938324	9.2297735	10.7702265	10.0061676	10.7763941	22
39	9.2243495	9.9938109	9.2305386	10.7694614	10.0061891	10.7756505	21
40	9.2250918	9.9937894	9.2313024	10.7686976	10.0062106	10.7749082	20
41	9.2258328	9.9937679	9.2320650	10.7679350	10.0062321	10.7741672	19
42	9.2265725	9.9937463	9.2328262	10.7671738	10.0062537	10.7734275	18
43	9.2273110	9.9937247	9.2335863	10.7664137	10.0062753	10.7726890	17
44	9.2280481	9.9937030	9.2343451	10.7656549	10.0062970	10.7719519	16
45	9.2287839	9.9936813	9.2351026	10.7648974	10.0063187	10.7712161	15
46	9.2295185	9.9936596	9.2358589	10.7641411	10.0063404	10.7704815	14
47	9.2302518	9.9936378	9.2366139	10.7633861	10.0063622	10.7697482	13
48	9.2309838	9.9936160	9.2373678	10.7626322	10.0063840	10.7690162	12
49	9.2317145	9.9935942	9.2381203	10.7618797	10.0064058	10.7682855	11
50	9.2324440	9.9935723	9.2388717	10.7611283	10.0064277	10.7675560	10
51	9.2331722	9.9935504	9.2396218	10.7603782	10.0064496	10.7668278	9
52	9.2338992	9.9935285	9.2403708	10.7596292	10.0064715	10.7661008	8
53	9.2346249	9.9935065	9.2411185	10.7588815	10.0064935	10.7653751	7
54	9.2353494	9.9934844	9.2418650	10.7581350	10.0065156	10.7646506	6
55	9.2360726	9.9934624	9.2426103	10.7573897	10.0065376	10.7639274	5
56	9.2367946	9.9934403	9.2433543	10.7566457	10.0065597	10.7632054	4
57	9.2375153	9.9934181	9.2440972	10.7559028	10.0065819	10.7624847	3
58	9.2382349	9.9933959	9.2448389	10.7551611	10.0066041	10.7617651	2
59	9.2389532	9.9933737	9.2455794	10.7544206	10.0066263	10.7610468	1
60	9.2396702	9.9933515	9.2463188	10.7536812	10.0066485	10.7603298	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

80 DEGREES.

Latitude 19 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.15	1	0.16	1	0.17	2	0.19	2	0.21	2	0.23	1	2.24	1	2.25	2	2.27	2	2.29	2	0.31	2	0.33	1	0.34
2	0.31	3	0.34	3	0.37	3	0.40	3	0.43	3	0.45	3	0.49	3	0.52	3	0.55	4	0.57	4	1.02	4	1.07	2	1.09
3	0.49	5	0.54	5	0.59	5	1.04	5	1.09	5	1.14	5	1.19	5	1.24	5	1.29	6	1.35	6	1.41	6	1.47	4	1.51
4	1.12	7	1.19	7	1.26	7	1.33	7	1.40	8	1.48	8	1.56	8	2.04	8	2.12	8	2.21	9	2.29	8	2.37	7	2.44
5	1.44	10	1.54	10	2.04	10	2.14	11	2.25	11	2.36	11	2.47	11	2.58	12	3.10	12	3.22	[illegible]	3.34	14	3.48	[illegible]	3.58
6	2.33	14	2.47	14	3.01	15	3.16	15	3.31	15	3.46	18	4.04	18	4.22	18	4.40	18	4.58	18	5.16	23	5.39		
7	3.54	21	4.15	21	4.36	21	4.57	21	5.17	21	5.39														
NE	6.00																								

10 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	1736482	9848077	1763270	56712818	10154267	57587705	60
1	1739346	9847571	1766269	56616509	10154788	57492861	59
2	1742211	9847065	1769269	56520516	10155310	57398333	58
3	1745075	9846558	1772269	56424838	10155833	57304121	57
4	1747939	9846050	1775269	56329474	10156357	57210223	56
5	1750803	9845541	1778270	56234421	10156882	57116636	55
6	1753667	9845031	1781271	56139680	10157408	57023360	54
7	1756531	9844521	1784272	56045247	10157935	56930393	53
8	1759395	9844010	1787274	55951121	10158463	56837734	52
9	1762258	9843498	1790276	55857302	10158992	56745380	51
10	1765121	9842985	1793278	55763786	10159521	56653331	50
11	1767984	9842471	1796281	55670574	10160051	56561584	49
12	1770847	9841956	1799284	55577663	10160582	56470140	48
13	1773710	9841440	1802287	55485052	10161114	56378995	47
14	1776573	9840924	1805291	55392740	10161647	56288148	46
15	1779435	9840407	1808295	55300724	10162181	56197599	45
16	1782298	9839889	1811299	55209005	10162716	56107345	44
17	1785160	9839370	1814303	55117579	10163252	56017386	43
18	1788022	9838850	1817308	55026446	10163789	55927719	42
19	1790884	9838329	1820313	54935604	10164327	55838343	41
20	1793746	9837808	1823318	54845052	10164866	55749258	40
21	1796607	9837286	1826324	54754738	10165406	55660460	39
22	1799469	9836763	1829330	54664812	10165946	55571950	38
23	1802330	9836239	1832336	54575121	10166487	55483726	37
24	1805191	9835714	1835343	54485715	10167029	55395786	36
25	1808052	9835189	1838350	54396592	10167572	55308129	35
26	1810913	9834663	1841357	54307750	10168116	55220754	34
27	1813774	9834136	1844365	54219188	10168661	55133659	33
28	1816635	9833608	1847373	54130906	10169207	55046843	32
29	1819495	9833079	1850381	54042901	10169754	54960305	31
30	1822355	9832549	1853390	53955172	10170302	54874043	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

79 DEGREES.

Latitude 20 Deg. 00 Min. *North Declination.*

	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18			d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	n.	h. m.	m.	h. m.	m.	h. m.			m.	h. m	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		N		12.0		12.0		12.0
1	0.14	1	0.13	1	0.12	2	0.10	2	00.8	1	00.7	1	00.6	2	00.4	2	00.2		1				00.2		00.3
2	0.28	2	0.26	3	0.23	3	0.20	3	0.17	2	0.15	2	0.13	3	0.10	3	00.7		2				00.4		00.6
3	0.45	5	0.40	5	0.35	6	0.29	6	0.23	5	0.18	5	0.13	6	0.07	6	00.1		3		Zenith.		00.6		0.10
4	1.07	6	1.01	7	0.54	7	0.47	7	0.40	6	0.34	7	0.27	7	0.20	7	0.13		4				00.9		0.16
5	1.36	9	1.27	9	1.18	10	1.08	10	0.58	9	0.49	9	0.40	10	0.30	10	0.20		5				0.13		0.24
6	2.21	13	2.08	14	1.54	14	1.40	14	1.26	13	1.13	14	0.59	14	0.45	14	0.31		6				0.22		0.40
7	3.37	19	3.18	19	2.59	19	2.40	20	2.20	19	2.01	19	1.42	20	1.32	20	1.02		7						
W E	5.32	23	5.09	23	4.46	23	4.23	23	4.00	23	3.37	23	3.14	23	2.51	23	2.28		W						
1											5.39	19	5.20	19	5.01	19	4.42								

10 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.2396702	9.9933515	9.2463188	10.7536812	10.0066485	10.7603298	60
1	9.2403861	9.9933292	9.2470569	10.7529431	10.0066708	10.7596139	59
2	9.2411007	9.9933068	9.2477939	10.7522061	10.0066932	10.7588993	58
3	9.2418141	9.9932845	9.2485297	10.7514703	10.0067155	10.7581859	57
4	9.2425264	9.9932621	9.2492643	10.7507357	10.0067379	10.7574736	56
5	9.2432374	9.9932396	9.2499978	10.7500022	10.0067604	10.7567626	55
6	9.2439472	9.9932171	9.2507301	10.7492699	10.0067829	10.7560528	54
7	9.2446558	9.9931946	9.2514612	10.7485388	10.0068054	10.7553442	53
8	9.2453632	9.9931720	9.2521912	10.7478088	10.0068280	10.7546368	52
9	9.2460695	9.9931494	9.2529200	10.7470800	10.0068506	10.7539305	51
10	9.2467746	9.9931268	9.2536477	10.7463523	10.0068732	10.7532254	50
11	9.2474784	9.9931041	9.2543743	10.7456257	10.0068959	10.7525216	49
12	9.2481811	9.9930814	9.2550997	10.7449003	10.0069186	10.7518189	48
13	9.2488827	9.9930587	9.2558240	10.7441760	10.0069413	10.7511173	47
14	9.2495830	9.9930359	9.2565472	10.7434528	10.0069641	10.7504170	45
15	9.2502822	9.9930131	9.2572691	10.7427308	10.0069869	10.7497178	45
16	9.2509803	9.9929902	9.2579901	10.7420099	10.0070098	10.7490197	44
17	9.2516772	9.9929673	9.2587099	10.7412901	10.0070327	10.7483228	43
18	9.2523729	9.9929444	9.2594285	10.7405715	10.0070556	10.7476271	42
19	9.2530675	9.9929214	9.2601461	10.7398539	10.0070786	10.7469325	41
20	9.2537609	9.9928984	9.2608625	10.7391375	10.0071016	10.7462391	40
21	9.2544532	9.9928753	9.2615779	10.7384221	10.0071247	10.7455468	39
22	9.2551444	9.9928522	9.2622921	10.7377079	10.0071478	10.7448556	38
23	9.2558344	9.9928291	9.2630053	10.7369947	10.0071709	10.7441656	37
24	9.2565233	9.9928059	9.2637173	10.7362827	10.0071941	10.7434767	36
25	9.2572110	9.9927827	9.2644283	10.7355717	10.0072173	10.7427890	35
26	9.2578977	9.9927595	9.2651382	10.7348618	10.0072405	10.7421023	34
27	9.2585832	9.9927362	9.2658470	10.7341530	10.0072638	10.7414168	33
28	9.2592676	9.9927129	9.2665547	10.7334453	10.0072871	10.7407324	32
29	9.2599509	9.9926895	9.2672613	10.7327387	10.0073105	10.7400491	31
30	9.2606330	9.9926661	9.2679669	10.7320331	10.0073339	10.7393670	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

79 DEGREES.

Latitude 20 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.16	1	0.17	1	0.18	1	0.19	2	0.21	2	0.23	1	0.24	1	0.25	2	0.27	2	0.29	2	0.31	2	0.33	1	0.34
2	0.32	3	0.35	3	0.38	3	0.41	3	0.44	4	0.48	3	0.51	3	0.54	3	0.57	4	1.01	4	1.05	3	1.08	3	1.11
3	0.51	4	0.55	4	0.59	4	1.03	4	1.07	5	1.12	6	1.18	6	1.24	6	1.30	6	1.36	7	1.43	6	1.49	4	1.53
4	1.16	7	1.23	7	1.30	7	1.37	7	1.44	7	1.51	8	1.59	8	2.07	8	2.15	8	2.23	8	2.31	9	2.40	7	2.47
5	1.48	10	1.58	10	2.08	10	2.18	10	2.28	11	2.39	11	2.40	11	2.51	12	3.03	12	3.15	12	3.37	13	3.50	10	4.00
6	2.38	14	2.52	14	3.06	14	3.20	15	3.35	15	3.50	17	4.07	17	4.24	17	4.41	17	4.58	18	5.16	22	5.38		
7	3.59	19	4.18	20	4.38	20	4.58	20	5.18	20	5.38														
W E	6.00																								

10 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	1822355	9832549	1853390	53955172	10170302	54874043	30
31	1825215	9832018	1856390	53867718	10170851	54788055	29
32	1828075	9831487	1859408	53780538	10171401	54702342	28
33	1830935	9830955	1862418	53693630	10171952	54616901	27
34	1833795	9830422	1865428	53606993	10172504	54531731	26
35	1836654	9829888	1868438	53520626	10173056	54446831	25
36	1839513	9829353	1871449	53434527	10173609	54362199	24
37	1842373	9828817	1874460	53348696	10174163	54277835	23
38	1845232	9828281	1877471	53263131	10174718	54193737	22
39	1848091	9827744	1880483	53177830	10175274	54109903	21
40	1850949	9827206	1883495	53092793	10175831	54026333	20
41	1853808	9826667	1886507	53008018	10176389	53943026	19
42	1856666	9826127	1889520	52923505	10176948	53859979	18
43	1859524	9825587	1892533	52839251	10177508	53777192	17
44	1862382	9825046	1895546	52755255	10178069	53694664	16
45	1865240	9824504	1898559	52671517	10178631	53612393	15
46	1868098	9823961	1901573	52588035	10179194	53530379	14
47	1870956	9823417	1904587	52504809	10179758	53448620	13
48	1873813	9822872	1907602	52421836	10180322	53367114	12
49	1876670	9822327	1010617	52339116	10180887	53285861	11
50	1879527	9821781	1913632	52256647	10181453	53204860	10
51	1882384	9821234	1916648	52174428	10182020	53124109	9
52	1885241	9820686	1919664	52092459	10182588	53043608	8
53	1888098	9820137	1922680	52010738	10183157	52963354	7
54	1890954	9819587	1925696	51929264	10183727	52883347	6
55	1893811	9819036	1928713	51848035	10184298	52803587	5
56	1896667	9818485	1931730	51767051	10184870	52724070	4
57	1899523	9817933	1934748	51686311	10185443	52644798	3
58	1902379	9817380	1937766	51605813	10186017	52565768	2
59	1905234	9816826	1940784	51525557	10186592	52486979	1
60	1908090	9916271	1943803	51445540	10187168	52408431	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

79 DEGREES.

Latitude 21 Deg. 00 Min. North Declination.

	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20			d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.			m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		N		12.0		12.0
1	0.14	1	0.13	1	0.12	1	0.11	2	00.9	1	00.8	1	00.7	2	00.5	2	00.3	2	00.1		1		00.1		00.2
2	0.30	3	0.27	3	0.24	3	0.21	3	0.18	3	0.15	3	0.12	3	00.9	3	00.6	4	00.2		2		00.2		00.4
3	0.48	4	0.44	5	0.39	5	0.34	5	0.29	5	0.24	5	0.19	5	0.14	5	00.9	6	00.3		3		00.3		00.7
4	1.10	6	1.04	7	0.57	7	0.50	7	0.43	7	0.36	8	0.28	8	0.20	8	0.12	8	00.4		4		00.4		0.11
5	1.40	9	1.31	9	1.22	9	1.13	10	1.03	11	0.52	11	0.41	11	0.30	12	0.18	12	00.6		5		00.6		0.17
6	2.26	14	2.12	14	1.58	14	1.44	15	1.29	15	1.14	16	0.58	16	0.42	16	0.25	16	0.10		6		0.11		0.40
7	3.41	18	3.23	18	3.05	18	2.47	18	2.29	25	2.04	26	1.38	26	1.12	26	0.46	26	0.20		7		0.24		
E	5.34	21	5.14	21	4.53	21	4.32	21	4.11	38	3.36	35	3.01	35	2.26	35	1.50	36	1.14						
1											5.50	24	5.26	24	5.02	25	4.37	25	4.12						

10 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.2606330	9.9926661	9.2679669	10.7320331	10.0073339	10.7393670	30
31	9.2613141	9.9926427	9.2686714	10.7313286	10.0073573	10.7386859	29
32	9.2619941	9.9926192	9.2693749	10.7306251	10.0073808	10.7380059	28
33	9.2626729	9.9925957	9.2700772	10.7299228	10.0074043	10.7373271	27
34	9.2633507	9.9925722	9.2707786	10.7292214	10.0074278	10.7366493	26
35	9.2640274	9.9925486	9.2714788	10.7285212	10.0074514	10.7359729	25
36	9.2647030	9.9925250	9.2721780	10.7278220	10.0074750	10.7352970	24
37	9.2653775	9.9925013	9.2728762	10.7271238	10.0074987	10.7346225	23
38	9.2660509	9.9924776	9.2735733	10.7264267	10.0075224	10.7339491	22
39	9.2667232	9.9924539	9.2742694	10.7257306	10.0075461	10.7332768	21
40	9.2673945	9.9924301	9.2749644	10.7250356	10.0075699	10.7326055	20
41	9.2680647	9.9924063	9.2756584	10.7243416	10.0075937	10.7319353	19
42	9.2687338	9.9923824	9.2763514	10.7236486	10.0076176	10.7312662	18
43	9.2694019	9.9923585	9.2770434	10.7229566	10.0076415	10.7305981	17
44	9.2700689	9.9923346	9.2777343	10.7222657	10.0076654	10.7299311	16
45	9.2707348	9.9923106	9.2784242	10.7215758	10.0076894	10.7292652	15
46	9.2713997	9.9922866	9.2791131	10.7208869	10.0077134	10.7286003	14
47	9.2720635	9.9922626	9.2798009	10.7201991	10.0077374	10.7279365	13
48	9.2727263	9.9922385	9.2804878	10.7195122	10.0077615	10.7272737	12
49	9.2733880	9.9922144	9.2811736	10.7188264	10.0077856	10.7266120	11
50	9.2740487	9.9921902	9.2818585	10.7181415	10.0078098	10.7259513	10
51	9.2747083	9.9921660	9.2825423	10.7174577	10.0078340	10.7252917	9
52	9.2753669	9.9921418	9.2832251	10.7167749	10.0078582	10.7246331	8
53	9.2760245	9.9921175	9.2839070	10.7160930	10.0078825	10.7239755	7
54	9.2766811	9.9920932	9.2845878	10.7154122	10.0079068	10.7233189	6
55	9.2773366	9.9920689	9.2852677	10.7147323	10.0079311	10.7226634	5
56	9.2779911	9.9920445	9.2859466	10.7140534	10.0079555	10.7220089	4
57	9.2786445	9.9920201	9.2866245	10.7133755	10.0079799	10.7213555	3
58	9.2792970	9.9919956	9.2873014	10.7126986	10.0080044	10.7207030	2
59	9.2799484	9.9919711	9.2879773	10.7120227	10.0080289	10.7200516	1
60	9.2705988	9.9919466	9.2886523	10.7113477	10.0080534	10.7194012	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

79 DEGREES.

Latitude 21 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.16	1	0.17	1	0.18	2	0.20	2	0.22	2	0.24	1	0.25	1	0.26	2	0.28	2	0.30	2	0.32	2	0.34	1	0.35
2	0.34	3	0.37	3	0.40	3	0.43	3	0.46	3	0.49	3	0.52	3	0.55	3	0.58	4	1.02	4	1.06	4	1.10	3	1.13
3	0.54	5	0.59	5	1.04	5	1.09	5	1.14	5	1.19	5	1.24	5	1.29	5	1.34	5	1.39	6	1.45	6	1.51	4	1.55
4	1.19	7	1.26	7	1.33	7	1.40	7	1.47	8	1.55	7	2.02	7	2.09	8	2.17	8	2.25	8	2.33	9	2.42	7	2.49
5	1.53	10	2.03	10	2.13	10	2.23	10	2.33	10	2.43	11	2.54	11	3.05	11	3.16	11	3.27	12	3.39	13	3.52	10	4.02
6	2.43	14	2.57	14	3.11	14	3.25	14	3.39	15	3.54	16	4.10	16	4.26	17	4.43	17	5.00	17	5.17				
7	4.04	19	4.23	19	4.42	19	5.01	19	5.20	19	5.39														
W E	6.00																								

11 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	1908090	9816271	1943803	51445540	10187168	52408431	60
1	1910945	9815716	1946822	51365763	10187744	52330121	59
2	1913800	9815160	1949841	51286224	10188321	52252050	58
3	1916655	9814603	1952861	51206921	10188899	52174216	57
4	1919510	9814045	1955881	51127855	10189478	52096618	56
5	1922365	9813486	1958901	51049024	10190058	52019254	55
6	1925220	9812926	1961922	50970426	10190639	51942125	54
7	1928074	9812366	1964943	50892061	10191221	51865228	53
8	1930928	9811805	1967964	50813928	10191804	51788563	52
9	1933782	9811243	1970986	50736025	10192388	51712128	51
10	1936636	9810680	1974008	50658352	10192973	51635924	50
11	1939490	9810116	1977030	50580907	10193559	51559948	49
12	1942344	9809551	1980053	50503690	10194146	51484199	48
13	1945197	9808986	1983076	50426700	10194734	51408677	47
14	1948050	9808420	1986100	50349935	10195323	51333381	46
15	1950903	9807853	1989124	50273395	10195912	51258309	45
16	1953756	9807285	1992148	50197078	10196502	51183461	44
17	1956609	9806716	1995172	50120984	10197093	51108835	43
18	1959461	9806146	1998197	50045111	10197685	51034431	42
19	1962314	9805576	2001222	49969459	10198278	50960248	41
20	1965166	9805005	2004248	49894027	10198872	50886284	40
21	1968018	9804433	2007274	49818813	10199467	50812539	39
22	1970870	9803860	2010300	49743817	10200063	50739012	38
23	1973722	9803286	2013327	49669037	10200660	50665701	37
24	1976573	9802711	2016354	49594474	10201258	50592606	36
25	1979425	9802136	2019381	49520125	10201857	50519726	35
26	1982276	9801560	2022409	49445990	10202457	50447060	34
27	1985127	9800983	2025437	49372068	10203058	50374607	33
28	1987978	9800405	2028465	49298358	10203660	50302367	32
29	1990829	9799826	2031494	49224859	10204263	50230337	31
30	1993679	9799247	2034523	49151570	10204867	50158517	30
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N.Tangent.	N.Co-Secant.	N. Secant.	M

78 DEGREES.

Latitude 22 Deg. 00 Min. North Declination.

	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20			d.	22	d.	23½
	b. m.	m.	b. m.	m.	b. m.	m.	b. m.	m.	b. m.	m.	b. m.	m.	b. m.	m.	b. m.	m.	b. m	m.	b. m.			m.	b. m	m.	b. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0						
1	0.15	1	0.14	1	0.13	2	0.11	2	00.9	1	00.8	1	00.7	1	00.6	2	00.4	2	00.2		N		12.0		12.0
2	0.31	2	0.29	3	0.26	3	0.23	3	0.20	3	0.17	3	0.14	3	0.11	3	00.8	4	00.4		1				00.1
3	0.50	4	0.46	4	0.42	5	0.37	5	0.32	5	0.27	5	0.22	5	0.17	5	0.12	6	00.6		2		Zenith.		00.3
4	1.14	6	1.08	7	1.01	7	0.54	7	0.47	7	0.40	8	0.32	8	0.24	8	0.16	8	00.8		3				00.4
5	1.45	9	1.36	9	1.27	9	1.18	10	1.08	11	0.57	11	0.46	11	0.35	11	0.24	11	0.13		4				00.7
6	2.30	12	2.18	12	2.06	13	1.53	13	1.40	16	1.24	16	1.08	16	0.52	16	0.36	16	0.20		5				0.10
7	3.46	16	3.30	17	3.13	17	2.56	17	2.39	24	2.15	24	1.51	24	1.27	25	1.02	25	0.37		6				0.17
W E	5.35	19	5.16	19	4.57	20	4.37	20	4.17	30	3.47	31	3.16	31	2.45	31	2.14	31	1.43						
1													5.34	24	5.10	30	4.40	19	4.21						

11 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.2805988	9.9919466	9.2886523	10.7113477	10.0080534	10.7194012	60
1	9.2812483	9.9919220	9.2893263	10.7106737	10.0080780	10.7187517	59
2	9.2818967	9.9918974	9.2899993	10.7100007	10.0081026	10.7181033	58
3	9.2825441	9.9918727	9.2906713	10.7093287	10.0081273	10.7174559	57
4	9.2831905	9.9918480	9.2913424	10.7086576	10.0081520	10.7168095	56
5	9.2838359	9.9918233	9.2920126	10.7079874	10.0081767	10.7161641	55
6	9.2844803	9.9917986	9.2926817	10.7073183	10.0082014	10.7155197	54
7	9.2851237	9.9917737	9.2933500	10.7066500	10.0082263	10.7148763	53
8	9.2857661	9.9917489	9.2940172	10.7059828	10.0082511	10.7142339	52
9	9.2864076	9.9917240	9.2946836	10.7053164	10.0082760	10.7135924	51
10	9.2870480	9.9916991	9.2953489	10.7046511	10.0083009	10.7129520	50
11	9.2876875	9.9916741	9.2960134	10.7039866	10.0083259	10.7123125	49
12	9.2883260	9.9916492	9.2966769	10.7033231	10.0083508	10.7116840	48
13	9.2889636	9.9916241	9.2973395	10.7026605	10.0083759	10.7110364	47
14	9.2896001	9.9915990	9.2980011	10.7019989	10.0084010	10.7103999	45
15	9.2902357	9.9915739	9.2986618	10.7013382	10.0084261	10.7097643	45
16	9.2908704	9.9915488	9.2993216	10.7006784	10.0084512	10.7091296	44
17	9.2915040	9.9915236	9.2999804	10.7000196	10.0084764	10.7084960	43
18	9.2921367	9.9914984	9.3006383	10.6993617	10.0085016	10.7078633	42
19	9.2927685	9.9914731	9.3012954	10.6987046	10.0085269	10.7072315	41
20	9.2933993	9.9914478	9.3019514	10.6980456	10.0085522	10.7066007	40
21	9.2940291	9.9914225	9.3026066	10.6973934	10.0085775	10.7059709	39
22	9.2946580	9.9913971	9.3032609	10.6967391	10.0086029	10.7053420	38
23	9.2952859	9.9913717	9.3039143	10.6960857	10.0086283	10.7047141	37
24	9.2959129	9.9913462	9.3045667	10.6954333	10.0086538	10.7040871	36
25	9.2965390	9.9913207	9.3052183	10.6947817	10.0086793	10.7034610	35
26	9.2971641	9.9912952	9.3058689	10.6941311	10.0087048	10.7028359	34
27	9.2977883	9.9912696	9.3065187	10.6934813	10.0087304	10.7022117	33
28	9.2984116	9.9912440	9.3071674	10.6928325	10.0087560	10.7015884	32
29	9.2990339	9.9912184	9.3078155	10.6921845	10.0087816	10.7009661	31
30	9.2996553	9.9911927	9.3084626	10.6915374	10.0088073	10.7003447	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

78 DEGREES.

Latitude 22 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	b. m.	m	b. m.	m.	b. m.	m.	b. m.	m.	b. m	m.	b. m.	m.	b. m.	m.	b. m	m.	b. m.	m.	b. m.	m.	b. m.	m.	b. m.	m.	b. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.17	1	0.18	1	0.19	2	0.21	2	0.23	2	0.25	1	0.26	1	0.27	1	0.28	2	0.30	2	0.32	2	0.34	1	0.35
2	0.35	3	0.38	3	0.41	3	0.44	3	0.47	4	0.51	3	0.54	3	0.57	3	1.00	3	1.03	4	1.07	4	1.11	2	1.13
3	0.56	5	1.01	5	1.06	5	1.11	5	1.16	5	1.21	5	1.26	5	1.31	5	1.36	5	1.41	6	1.47	5	1.52	5	1.57
4	1.22	7	1.29	7	1.36	7	1.43	7	1.50	8	1.58	7	2.05	7	2.12	8	2.20	8	2.28	8	2.36	8	2.44	7	2.51
5	1.57	9	2.06	9	2.15	10	2.25	10	2.35	10	2.45	11	2.56	11	3.07	11	3.18	12	3.30	12	3.42	12	3.54	10	4.04
6	[illegible]	13	3.02	13	3.15	14	3.29	14	3.43	14	3.57	16	4.13	16	4.29	16	4.45	16	5.01	16	5.17				
7	4.08	18	4.26	18	4.44	18	5.02	18	5.20	19	5.39														
[illegible]																									

11 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	1993679	9799247	2034523	49151570	10204867	50158517	30
31	1996530	9798667	2037552	49078491	10205471	50086907	29
32	1999380	9798086	2040582	49005620	10206076	50015505	28
33	2002230	9797504	2043612	48932956	10206682	49944311	27
34	2005080	9796921	2046643	48860499	10207289	49873323	26
35	2007930	9796337	2049674	48788248	10207897	49802541	25
36	2010779	9795752	2052705	48716201	10208506	49731964	24
37	2013629	9795167	2055737	48644359	10209116	49661591	23
38	2016478	9794581	2058769	48572719	10209727	49591421	22
39	2019327	9793994	2061801	48501282	10210339	49521453	21
40	2022176	9793406	2064834	48430045	10210952	49451687	20
41	2025024	9792817	2067867	48359010	10211566	49382120	19
42	2027873	9792228	2070900	48288174	10212181	49312754	18
43	2030721	9791638	2073934	48217536	10212797	49243586	17
44	2033569	9791047	2076968	48147096	10213414	49174616	16
45	2036417	9790455	2080003	48076854	10214032	49105844	15
46	2039265	9789862	2083038	48006806	10214650	49037267	14
47	2042113	9789268	2086073	47936957	10215269	48968886	13
48	2044961	9788674	2089109	47867300	10215889	48900700	12
49	2047808	9788079	2092145	47797837	10216510	48832707	11
50	2050655	9787483	2095181	47728567	10217132	48764907	10
51	2053502	9786886	2098218	47659490	10217755	48697299	9
52	2056349	9786288	2101255	47590603	10218379	48629883	8
53	2059195	9785689	2104293	47521907	10219004	48562657	7
54	2062042	9785090	2107331	47453401	10219630	48495621	6
55	2064888	9784490	2110369	47385083	10220257	48428774	5
56	2067734	9783889	2113407	47316954	10220885	48362114	4
57	2070580	9783287	2116446	47249012	10221514	48295643	3
58	2073426	9782684	2119485	47181256	10222144	48229357	2
59	2076271	9782080	2122525	47113686	10222775	48163258	1
60	2079117	9781476	2125565	47046301	10223407	48097343	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

78 DEGREES.

Latitude 23 Deg. 00 Min. North Declination.

	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.		d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.		m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		N S		12.0
1	0.16	1	0.15	1	0.14	1	0.13	2	0.11	1	0.10	1	00.9	2	00.7	2	00.5	2	00.3	2	00.1		1		00.0
2	0.33	2	0.31	3	0.28	3	0.25	3	0.22	3	0.19	3	0.16	3	0.13	4	00.9	4	00.5	3	00.2		2		00.1
3	0.53	4	0.49	5	0.45	5	0.40	6	[illegible]	5	0.29	5	0.24	5	0.19	5	0.14	5	00.9	6	[illegible]		3		00.1
4	1.17	6	1.11	7	1.04	7	0.57	7	[illegible]	7	0.43	7	0.36	7	0.29	8	0.21	8	0.13	9	00.4		4		00.2
5	1.49	9	1.40	9	1.31	9	1.22	9	1.13	10	1.03	11	0.52	11	0.41	11	0.30	11	0.19	13	00.6		5		00.3
6	2.37	12	2.25	12	2.13	13	[illegible]	13	1.47	15	1.32	15	1.17	16	1.01	16	0.45	16	0.29	19	0.10		6		00.6
7	3.51	16	3.35	16	3.19	17	[illegible]	17	2.45	21	2.24	21	[illegible]	21	1.42	21	1.21	22	0.59	39	0.20				
W E	5.36	18	5.18	18	5.02	19	4.41	19	4.22	27	3.55	27	3.28	28	3.00	28	2.32	28	2.04	53	1.11				
1									6.21	22	5.59	22	5.37	22	5.15	23	4.52	23	4.29	33	3.56				

11 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.2996553	9.9911927	9.3084626	10.6915374	10.0088073	10.7003447	30
31	9.3002758	9.9911670	9.3091088	10.6908912	10.0088330	10.6997242	29
32	9.3008953	9.9911412	9.3097541	10.6902459	10.0088588	10.6991047	28
33	9.3015140	9.9911154	9.3103985	10.6896015	10.0088846	10.6984860	27
34	9.3021317	9.9910896	9.3110421	10.6889579	10.0089104	10.9978683	26
35	9.3027485	9.9910637	9.3116848	10.6883152	10.0089363	10.6972515	25
36	9.3033644	9.9910378	9.3123266	10.6876734	10.0089622	10.6966356	24
37	9.3039794	9.9910119	9.3129675	10.6870325	10.0089881	10.6960206	23
38	9.3045934	9.9909859	9.3136076	10.6863924	10.0090141	10.6954066	22
39	9.3052066	9.9909598	9.3142468	10.6857532	10.0090402	10.6947934	21
40	9.3058189	9.9909338	9.3148851	10.6851149	10.0090662	10.6941811	20
41	9.3064303	9.9909077	9.3155226	10.6844774	10.0090923	10.6935697	19
42	9.3070407	9.9908815	9.3161592	10.6838408	10.0091185	10.6929593	18
43	9.3076503	9.9908553	9.3167950	10.6832050	10.0091447	10.6923497	17
44	9.3082590	9.9908291	9.3174299	10.6825701	10.0091709	10.6917410	16
45	9.3088668	9.9908029	9.3180640	10.6819360	10.0091971	10.6911332	15
46	9.3094737	9.9907766	9.3186972	10.6813028	10.0092234	10.6905263	14
47	9.3100798	9.9907502	9.3193295	10.6806705	10.0092498	10.6899202	13
48	9.3106849	9.9907239	9.3199611	10.6800389	10.0092761	10.6893151	12
49	9.3112892	9.9906974	9.3205918	10.6794082	10.0093025	10.6887108	11
50	9.3118926	9.9906710	9.3212216	10.6787784	10.0093290	10.6881074	10
51	9.3124951	9.9906445	9.3218506	10.6781494	10.0093555	10.6875049	9
52	9.3130968	9.9906180	9.3224788	10.6775212	10.0093820	10.6869032	8
53	9.3136976	9.9905914	9.3231061	10.6768939	10.0094086	10.6863024	7
54	9.3142975	9.9905648	9.3237327	10.6762673	10.0094352	10.6857025	6
55	9.3148965	9.9905382	9.3243584	10.6756416	10.0094618	10.6851035	5
56	9.3154947	9.9905115	9.3249832	10.6750168	10.0094885	10.6845053	4
57	9.3160921	9.9904848	9.3256073	10.6743927	10.0095152	10.6839079	3
58	9.3166885	9.9904580	9.3262305	10.6737695	10.0095420	10.6833115	2
59	9.3172841	9.9904312	9.3268529	10.6731471	10.0095688	10.6827159	1
60	9.3178789	9.9904044	9.3274745	10.6725255	10.0095956	10.6821211	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

78 DEGREES.

Latitude 23 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.18	1	0.19	1	0.20	2	0.22	2	0.24	2	0.26	1	0.27	1	0.28	2	[illegible]	2	0.32	2	0.34	1	[illegible]	1	0.36
2	0.37	2	0.39	3	0.42	3	0.45	3	0.48	3	0.51	3	0.54	3	0.57	3	[illegible]	4	1.04	4	1.08	4	1.12	3	1.15
3	0.59	4	1.03	5	1.08	5	1.13	5	1.18	5	1.23	5	1.28	5	[illegible]	5	1.38	5	1.43	6	1.49	5	1.54	5	1.59
4	1.25	7	1.42	7	1.49	7	1.56	7	2.03	7	[illegible]	7	[illegible]	8	2.15	8	[illegible]	8	2.31	8	2.39	7	2.46	7	2.53
5	2.01	9	2.10	10	2.20	10	2.30	10	2.40	10	[illegible]	10	[illegible]	11	3.11	11	3.22	11	[illegible]	11	3.44	12	3.56	10	4.06
6	2.53	13	3.06	13	3.19	13	[illegible]	14	3.46	14	[illegible]	15	[illegible]	15	[illegible]	15	4.45	16	[illegible]	[illegible]	[illegible]				
7	4.12	17	4.29	17	4.46	17	[illegible]	18	5.21	18	5.39														
W E	6.00																								

12 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	2079117	9781476	2125565	47046301	10223407	48097343	60
1	2081962	9780871	2128606	46979100	10224040	48031613	59
2	2084807	9780265	2131647	46912083	10224673	47966066	58
3	2087652	9779658	2134688	46845248	10225307	47900702	57
4	2090497	9779050	2137730	46778595	10225942	47835520	56
5	2093341	9778441	2140772	36712124	10226578	47770519	55
6	2096186	9777832	2143814	46645832	10227215	47705699	54
7	2099030	9777222	2146857	46579721	10227853	47641058	53
8	2101874	9776611	2149900	46513788	10228492	47576596	52
9	2104718	9775999	2152944	46448034	10229132	47512312	51
10	2107561	9775386	2155988	46382457	10229773	47438206	50
11	2110405	9774773	2159032	46317056	10230415	47384277	49
12	2113248	9774159	2162077	46251832	10231058	47320523	48
13	2116091	9773544	2165122	46186783	10231702	47256945	47
14	2118934	9772928	2168167	46121908	10232347	47193542	46
15	2121777	9772311	2171213	46057207	10232993	47130313	45
16	2124619	9771693	2174259	45992680	10233640	47067256	44
17	2127462	9771075	2177306	45928325	10234288	47004372	43
18	2130304	9770456	2180353	45864141	10234937	46941660	42
19	2133146	9769836	2183400	45800129	10235587	46879119	41
20	2135988	9769215	2186448	45736287	10236238	46816748	40
21	2138829	9768593	2189496	45672614	10236890	46754548	39
22	2141671	9767970	2192544	45609111	10237543	46692516	38
23	2144512	9767347	2195593	45545776	10238196	46630652	37
24	2147353	9766723	2198642	45482608	10238850	46568956	36
25	2150194	9766098	2201692	45419608	10239505	46507427	35
26	2153035	9765472	2204742	45356773	10240161	46446064	34
27	2155876	9764845	2207793	45294105	10240818	46384867	33
28	2158716	9764217	2210844	45231601	10241476	46323835	32
29	2161556	9763589	2213895	45169261	10242135	46262967	31
30	2164396	9762960	2216947	45107085	10242795	46202263	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

77 DEGREES.

Latitude 24 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.17	1	0.16	1	0.15	1	0.14	1	0.13	2	0.11	1	0.10	1	00.9	1	00.8	2	00.6	2	00.4	2	00.2	2	00.0
2	0.35	2	0.33	2	0.31	2	0.29	3	0.26	3	0.23	3	0.20	3	0.17	3	0.14	3	0.11	4	00.7	3	00.4	3	00.1
3	0.55	3	0.52	3	0.49	4	0.45	4	0.41	4	0.37	5	0.32	5	0.27	5	0.22	5	0.17	6	0.11	5	00.6	5	00.1
4	1.20	5	1.15	5	1.10	5	1.05	6	0.59	6	0.53	7	0.46	7	0.39	7	0.32	7	0.25	8	0.17	8	00.9	7	00.2
5	1.54	7	1.47	7	1.40	7	1.33	7	1.26	8	1.18	11	1.07	11	0.56	11	0.45	12	0.33	12	0.21	9	0.12	9	00.3
6	2.42	9	2.33	10	2.23	10	2.13	10	2.03	10	1.53	15	1.38	15	1.23	15	1.08	15	4.53	15	0.38	18	0.20	15	00.5
7	3.56	12	3.44	13	3.31	13	3.18	13	3.05	13	2.52	21	2.31	21	2.10	21	1.49	21	1.28	21	1.07	34	0.33	23	0.10
W E	5.37										4.27	25	4.22	25	3.37	25	3.12	25	2.47	26	2.21	42	1.39	50	0.49
1											6.21	21	6.20	21	5.59	21	5.38	21	5.17	22	4.35	29	4.06	27	3.39
2																							6.24	25	6.09

12 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.3178789	9.9904044	9.3274745	10.6725255	10.0095956	10.6821211	60
1	9.3184728	9.9903775	9.3280953	10.6719047	10.0096225	10.6815272	59
2	9.3190659	9.9903506	9.3287153	10.6712847	10.0096494	10.6809341	58
3	9.3196581	9.9903237	9.3293345	10.6706655	10.0096763	10.6803419	57
4	9.3202495	9.9902967	9.3299528	10.6700472	10.0097033	10.6797505	56
5	9.3208400	9.9902697	9.3305704	10.6694296	10.0097303	10.6791600	55
6	9.3214297	9.9902426	9.3311872	10.6688128	10.0097574	10.6785703	54
7	9.3220186	9.9902155	9.3318031	10.6681969	10.0097845	10.6779814	53
8	9.3226066	9.9901883	9.3324183	10.6675817	10.0098117	10.6773934	52
9	9.3231938	9.9901612	9.3330327	10.6669673	10.0098388	10.6768062	51
10	9.3237802	9.9901339	9.3336463	10.6663537	10.0098661	10.6762198	50
11	9.3243657	9.9901067	9.3342591	10.6657409	10.0098933	10.6756343	49
12	9.3249505	9.9900794	9.3348711	10.6651289	10.0099206	10.6750495	48
13	9.3255344	9.9900521	9.3354823	10.6645177	10.0099479	10.6744656	47
14	9.3261174	9.9900247	9.3360927	10.6639073	10.0099753	10.6738826	46
15	9.3266997	9.9899973	9.3367024	10.6632976	10.0100027	10.6733003	45
16	9.3272811	9.9899698	9.3373113	10.6626887	10.0100302	10.6727189	44
17	9.3278617	9.9899423	9.3379194	10.6620806	10.0100577	10.6721383	43
18	9.3284416	9.9899148	9.3385267	10.6614733	10.0100852	10.6715584	42
19	9.3290206	9.9898873	9.3391333	10.6608667	10.0101127	10.6709794	41
20	9.3295988	9.9898597	9.3397391	10.6602609	10.0101403	10.6704012	40
21	9.3301761	9.9898320	9.3403441	10.6596559	10.0101690	10.6698239	39
22	9.3307527	9.9898043	9.3409484	10.6590516	10.0101957	10.6692473	38
23	9.3313285	9.9897766	9.3415519	10.6584481	10.0102234	10.6686715	37
24	9.3319035	9.9897489	9.3421546	10.6578454	10.0102511	10.6680965	36
25	9.3324777	9.9897211	9.3427566	10.6572434	10.0102789	10.6675223	35
26	9.3330511	9.9896932	9.3433578	10.6566422	10.0103068	10.6669489	34
27	9.3336237	9.9896654	9.3439583	10.6560417	10.0103346	10.6663763	33
28	9.3341955	9.9896374	9.3445580	10.6554420	10.0103626	10.6658045	32
29	9.3347665	9.9896095	9.3451570	10.6548430	10.0103905	10.6652335	31
30	9.3353368	9.9895815	9.3457552	10.6542448	10.0104185	10.6646632	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

77 DEGREES.

Latitude 24 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.18	1	0.19	1	0.20	2	0.22	2	0.24	2	0.26	1	0.27	1	0.28	1	0.29	2	0.31	2	0.33	2	0.35	2	0.37
2	0.38	3	0.41	3	0.44	3	0.47	3	0.50	3	0.53	3	0.56	3	0.59	3	1.02	4	1.06	4	1.10	3	1.13	3	1.16
3	1.01	4	1.05	5	1.10	5	1.15	5	1.20	5	1.25	5	1.30	5	1.35	5	1.40	5	1.45	5	1.50	6	1.56	4	2.00
4	1.29	7	1.36	7	1.43	7	1.50	7	1.57	7	2.04	7	2.11	7	2.18	7	2.25	7	2.32	8	2.40	9	2.49	6	2.55
5	2.05	9	2.14	9	2.23	10	2.33	10	2.43	10	2.53	10	3.03	10	3.13	11	3.24	11	3.35	11	3.46	12	3.58	10	4.08
6	2.58	12	3.10	13	3.23	13	3.36	13	3.49	13	4.02	15	4.17	15	4.32	15	4.47	15	5.02	16	5.18				
7	4.16	16	4.32	16	4.48	17	5.05	17	5.22	17	5.39														
W E	6.00																								

12 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	2164396	9762960	2216947	45107085	10242795	46202263	30
31	2167236	9762330	2219999	45045072	10243456	46141722	29
32	2170076	9761699	2223051	44983221	10244118	46081343	28
33	2172915	9761067	2226104	44921532	10244781	46021126	27
34	2175754	9760435	2229157	44860004	10245445	45961070	26
35	2178593	9759802	2232211	44798636	10246110	45901174	25
36	2181432	9759168	2235265	44737428	10246776	45841439	24
37	2184271	9758533	2238319	44676379	10247443	45781862	23
38	2187110	9757897	2241374	44615489	10248111	45722444	22
39	2189948	9757260	2244429	44554756	10248780	45663183	21
40	2192786	9756623	2247485	44494181	10249449	45604080	20
41	2195624	9755985	2250541	44433762	10250119	45545134	19
42	2198462	9755346	2253597	44373499	10250790	45486344	18
43	2201300	9754706	2256654	44313392	10251462	45427709	17
44	2204137	9754065	2259711	44253439	10252135	45369229	16
45	2206974	9753423	2262769	44193641	10252809	45310903	15
46	2209811	9752781	2265827	44133996	10253484	45252730	14
47	2212648	9752138	2268885	44074504	10254160	45194711	13
48	2215485	9751494	2271944	44015164	10254837	45136844	12
49	2218321	9750849	2275003	43955976	10255515	45079129	11
50	2221158	9750203	2278063	43896940	10256194	45021565	10
51	2223994	9749556	2281123	43838054	10256874	44964152	9
52	2226830	9748909	2284183	43779317	10257555	44906889	8
53	2229666	9748261	2287244	43720731	10258237	44849775	7
54	2232501	9747612	2290305	43662293	10258920	44792810	6
55	2235337	9746962	2293367	43604003	10259604	44735993	5
56	2238172	9746311	2296429	43545861	10260289	44679324	4
57	2241007	9745660	2299492	43487866	10260975	44622803	3
58	2243841	9745008	2302555	43430018	10261662	44566428	2
59	2246676	9744355	2305618	43372316	10262350	44510198	1
60	2249511	9743701	2308682	43314759	10263039	44454115	0
	N. Co-Sine.	N. Sine.	N.Co-Tang	N. Tangent.	N.Co.Secant.	N. Secant.	M

77 DEGREES.

Latitude 25 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.19	1	0.18	1	0.17	1	0.16	2	0.14	2	0.12	1	0.11	1	0.10	2	00.8	2	00.6	2	00.4	2	00.2	1	00.1
2	0.40	3	0.37	3	0.34	3	0.31	3	0.28	3	0.25	3	0.22	3	0.19	3	0.16	3	0.13	4	00.9	4	00.5	2	00.3
3	1.03	4	0.59	5	0.54	5	0.49	5	0.44	5	0.39	5	0.34	5	0.29	5	0.24	5	0.19	5	0.14	5	00.9	5	00.4
4	1.32	7	1.25	7	1.18	7	1.11	7	1.04	7	0.57	7	0.50	7	0.43	7	0.36	7	0.29	8	0.21	8	0.13	7	00.6
5	2.09	9	2.00	9	1.51	9	2.42	10	2.32	10	1.22	10	1.12	10	1.02	10	0.52	10	0.42	11	0.31	12	0.19	9	0.10
6	3.02	12	2.50	12	2.38	12	2.26	13	2.13	13	2.00	14	1.46	14	1.32	15	1.17	15	1.02	15	0.47	18	0.29	14	0.15
7	4.19	16	4.03	16	3.47	16	3.31	16	3.15	16	2.59	20	2.39	20	2.19	20	1.59	20	1.39	20	1.19	26	0.53	24	0.29
W E	6.00	17	5.43	18	5.25	18	5.07	18	4.49	18	4.31	23	4.08	23	3.45	23	3.22	23	2.59	24	2.35	35	2.00	36	1.24
1											6.21	20	6.01	20	5.41	20	5.21	20	5.01	20	4.41	27	4.14	24	3.50
2																							6.25	15	6.10

12 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.3353368	9.9895815	9.3457552	10.6542448	10.0104185	10.6646632	30
31	9.3359062	9.9895535	9.3463527	10.6536473	10.0104465	10.6640938	29
32	9.3364749	9.9895254	9.3469494	10.6530506	10.0104746	10.6635251	28
33	9.3370428	9.9894973	9.3475454	10.6524546	10.0105027	10.6629572	27
34	9.3376099	9.9894692	9.3481407	10.6518593	10.0105308	10.9623901	26
35	9.3381762	9.9894410	9.3487352	10.6512648	10.0105590	10.6618274	25
36	9.3387418	9.9894128	9.3493290	10.6506710	10.0105872	10.6612582	24
37	9.3393065	9.9893845	9.3499220	10.6500780	10.0106155	10.6606935	23
38	9.3398706	9.9893562	9.3505143	10.6494857	10.0106438	10.6601293	22
39	9.3404338	9.9893279	9.3511059	10.6488941	10.0106721	10.6595662	21
40	9.3409963	9.9892995	9.3516968	10.6483032	10.0107005	10.6590037	20
41	9.3415580	9.9892711	9.3522869	10.6377131	10.0107289	10.6584420	19
42	9.3421190	9.9892427	9.3528763	10.6471237	10.0107573	10.6578810	18
43	9.3426792	9.9892142	9.3534650	10.6465350	10.0107858	10.6573208	17
44	9.3432386	9.9891856	9.3540530	10.6459470	10.0108144	10.6567614	16
45	9.3437973	9.9891571	9.3546402	10.6453598	10.0108429	10.6562027	15
46	9.3443552	9.9891285	9.3552267	10.6447733	10.0108716	10.6556448	14
47	9.3449124	9.9890998	9.3558126	10.6441874	10.0109002	10.6550876	13
48	9.3454688	9.9890711	9.3563977	10.6436023	10.0109289	10.6545312	12
49	9.3460245	9.9890424	9.3569821	10.6430179	10.0109576	10.6539755	11
50	9.3465794	9.9890137	9.3575658	10.6424342	10.0109863	10.6534206	10
51	9.3471336	9.9889849	9.3581487	10.6418513	10.0110151	10.6528664	9
52	9.3476870	9.9889560	9.3587310	10.6412690	10.0110440	10.6523130	8
53	9.3482397	9.9889271	9.3593126	10.6406874	10.0110729	10.6517603	7
54	9.3487917	9.9888982	9.3598935	10.6401065	10.0111018	10.6512083	6
55	9.3493429	9.9888693	9.3604736	10.6395264	10.0111307	10.6506561	5
56	9.3498934	9.9888403	9.3610531	10.6389469	10.0111597	10.6501066	4
57	9.3504432	9.9888113	9.3616319	10.6383681	10.0111887	10.6495568	3
58	9.3509922	9.9887822	9.3622100	10.6377900	10.0112178	10.6490078	2
59	9.3515405	9.9887531	9.3627874	10.6372126	10.0112469	10.6484595	1
60	9.3520880	9.9887239	9.3633641	10.6366359	10.0112761	10.6479120	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

77 DEGREES.

Latitude 25 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	*m*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m*	*h. m.*
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.19	1	0.20	1	0.21	2	0.23	2	0.25	2	0.27	1	0.28	1	0.29	1	0.30	2	0.32	2	0.34	2	0.36	2	0.38
2	0.40	3	0.43	3	0.46	3	0.49	3	0.52	3	0.55	3	0.58	3	1.01	3	1.04	3	1.07	4	1.11	3	1.14	3	1.17
3	1.03	4	1.07	5	1.12	5	1.17	5	1.22	5	1.27	5	1.32	5	1.37	5	1.42	5	1.47	5	1.52	6	1.58	4	2.02
4	1.32	6	1.38	7	1.45	7	1.52	7	1.59	7	2.05	7	2.12	7	2.20	7	2.27	7	2.34	8	2.42	8	2.50	7	2.57
5	2.09	9	2.18	9	2.27	9	2.36	10	2.46	10	2.56	10	3.06	10	3.16	10	3.26	11	3.37	11	3.48	12	4.00	9	4.09
6	3.02	12	3.14	12	3.26	13	3.39	13	3.52	13	4.05	14	4.19	15	4.34	15	4.49	15	5.04	15	5.19				
7	4.19	16	4.33	16	4.51	16	5.07	16	5.23	16	5.39														
W E	6.00																								

13 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	2249511	9743701	2308682	43314759	10263039	44454115	60
1	2252345	9743046	2311746	43257347	10263729	44398176	59
2	2255179	9742390	2314811	43200079	10264420	44342382	58
3	2258013	9741734	2317876	43142955	10265112	44286731	57
4	2260846	9741077	2320941	43085974	10265805	44231224	56
5	2263680	9740419	2324007	43029136	10266499	44175859	55
6	2266513	9739760	2327073	42972440	10267194	44120637	54
7	2269346	9739100	2330140	42915885	10267890	44065556	53
8	2272179	9738439	2333207	42859472	10268587	44010616	52
9	2275012	9737778	2336274	42803199	10269284	43955817	51
10	2277844	9737116	2339342	42747066	10269982	43901158	50
11	2280677	9736453	2342410	42691072	10270681	43846638	49
12	2283509	9735789	2345479	42635218	10271381	43792257	48
13	2286341	9735124	2348548	42579501	10272082	43738015	47
14	2289172	9734458	2351617	42523923	10272784	43683910	46
15	2292004	9733792	2354687	42468482	10273487	43629943	45
16	2294835	9733125	2357758	42413177	10274191	43576113	44
17	2297666	9732457	2360829	42358009	10274896	43522419	43
18	2300497	9731788	2363900	42302977	10275602	43468861	42
19	2303328	9731118	2366972	42248080	10276309	43415438	41
20	2306159	9730448	2370044	42193318	10277017	43362150	40
21	2308989	9729777	2373116	42138690	10277726	43308996	39
22	2311819	9729105	2376189	42084196	10278436	43255977	38
23	2314649	9728432	2379262	42029835	10279147	43203090	37
24	2317479	9727758	2382336	41975606	10279859	43150336	36
25	2320309	9727084	2385410	41921510	10280572	43097715	35
26	2323138	9726409	2388485	41867546	10281286	43045225	34
27	2325967	9725733	2391560	41813713	10282001	42992867	33
28	2328796	9725056	2394635	41760011	10282717	42940640	32
29	2331625	9724378	2397711	41706440	10283434	42888543	31
30	2334454	9723699	2300787	41652998	10284152	42836576	30
	N. Co-Sine.	N. Sine.	N.Co-Tang	N. Tangent.	N.Co-Secant.	N. Secant.	M

76 DEGREES.

Latitude 26 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.20	1	0.19	1	0.18	1	0.17	2	0.15	2	0.13	1	0.12	1	0.11	2	00.9	2	00.7	2	00.5	2	00.3	1	00.2
2	0.41	3	0.38	3	0.35	3	0.32	3	0.29	3	0.26	3	0.23	3	0.20	3	0.17	3	0.14	3	0.11	4	00.7	3	00.4
3	1.05	4	1.01	4	0.57	5	0.52	5	0.47	5	0.42	5	0.37	5	0.32	5	0.27	5	0.22	5	0.17	6	0.11	4	00.7
4	1.35	6	1.29	7	1.22	7	1.15	7	1.08	7	1.01	7	0.54	7	0.47	7	0.40	7	0.33	8	0.25	8	0.17	6	0.11
5	2.13	9	2.04	9	1.55	9	1.46	9	1.37	10	1.27	[illegible]	1.17	10	1.07	10	0.57	10	0.47	11	0.36	11	0.25	9	0.16
6	3.07	12	2.55	12	2.43	12	2.31	12	2.19	13	2.06	14	1.52	14	1.38	14	1.24	14	1.10	15	0.55	17	0.38	13	0.25
7	4.22	15	4.07	15	3.52	15	3.37	15	3.22	16	3.06	19	2.47	19	2.28	19	2.09	19	1.50	19	1.31	24	1.07	22	0.45
W.E	6.00	17	5.43	17	5.26	17	5.09	17	4.52	17	4.35	21	4.14	21	3.53	22	3.31	22	3.19	22	2.47	31	2.16	29	1.47
1											6.21	19	6.02	19	5.43	19	5.24	19	5.05	19	4.46	24	4.22	22	4.00
2																					6.42	17	6.25	03	6.12

13 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.3520880	9.9887239	9.3633641	10.6366359	10.0112761	10.6479120	60
1	9.3526349	9.9886947	9.3639401	10.6360599	10.0113053	10.6473651	59
2	9.3531810	9.9886655	9.3645155	10.6354845	10.0113345	10.6468190	58
3	9.3537264	9.9886363	9.3650901	10.6349099	10.0113637	10.6462736	57
4	9.3542710	9.9886070	9.3656641	10.6343359	10.0113930	10.6457290	56
5	9.3548150	9.9885776	9.3662374	10.6337626	10.0114224	10.6451850	55
6	9.3553582	9.9885482	9.3668100	10.6331900	10.0114518	10.6446418	54
7	9.3559149	9.9885188	9.3673819	10.6326181	10.0114812	10.6440993	53
8	9.3564426	9.9884894	9.3679532	10.6320468	10.0115106	10.6435574	52
9	9.3569836	9.9884599	9.3685238	10.6314762	10.0115401	10.6430164	51
10	9.3575240	9.9884303	9.3690937	10.6309063	10.0115697	10.6424760	50
11	9.3580637	9.9884008	9.3696629	10.6303371	10.0115992	10.6419363	49
12	9.3586027	9.9883712	9.3702315	10.6297685	10.0116288	10.6413973	48
13	9.3591409	9.9883415	9.3707994	10.6292006	10.0116585	10.6408591	47
14	9.3596785	9.9883118	9.3713667	10.6286333	10.0116882	10.6403215	46
15	9.3602154	9.9882821	9.3719333	10.6280667	10.0117179	10.6397846	45
16	9.3607515	9.9882523	9.3724992	10.6275008	10.0117477	10.6392485	44
17	9.3612870	9.9882225	9.3730645	10.6269355	10.0117775	10.6387130	43
18	9.3618217	9.9881927	9.3736291	10.6263709	10.0118073	10.6381783	42
19	9.3623558	9.9881628	9.3741930	10.6258070	10.0118372	10.6376442	41
20	9.3628892	9.9881329	9.3747563	10.6252437	10.0118671	10.6371108	40
21	9.3634219	9.9881029	9.3753190	10.6246810	10.0118971	10.6365781	39
22	9.3639539	9.9880729	9.3758810	10.6241190	10.0119271	10.6360461	38
23	9.3644852	9.9880429	9.3764423	10.6235577	10.0119571	10.6355148	37
24	9.3650158	9.9880128	9.3770030	10.6229970	10.0119872	10.6349842	36
25	9.3655458	9.9879827	9.3775631	10.6224369	10.0120173	10.6341542	35
26	9.3660750	9.9879525	9.3781225	10.6218775	10.0120475	10.6339250	34
27	9.3666036	9.9879223	9.3786813	10.6213187	10.0120777	10.6333964	33
28	9.3671315	9.9878921	9.3792394	10.6207606	10.0121079	10.6328685	32
29	9.3676587	9.9878618	9.3797969	10.6202031	10.0121382	10.6323413	31
30	9.3681853	9.9878315	9.3803537	10.6196463	10.0121685	10.6318147	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

76 DEGREES.

Latitude 26 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.21	1	0.22	1	0.23	1	0.24	1	0.25	2	0.27	1	0.28	1	0.29	2	0.31	2	0.33	2	0.35	1	0.36	2	0.38
2	0.41	3	0.44	3	0.47	3	0.50	3	0.53	3	0.56	3	0.59	3	1.02	3	1.05	3	1.08	4	1.12	3	1.15	3	1.18
3	1.05	4	1.09	5	1.14	5	1.19	5	1.24	5	1.29	5	1.34	5	1.39	5	1.44	5	1.49	5	1.54	5	1.59	4	2.03
4	1.35	6	1.41	6	1.47	7	1.54	7	2.01	7	2.08	7	2.15	7	2.22	7	2.29	7	2.36	8	2.44	8	2.52	7	2.59
5	2.13	9	2.22	9	2.31	9	2.40	9	2.49	10	2.59	12	3.11	12	3.23	12	3.35	12	3.47	13	3.5[illegible]	11	4.01	9	4.10
6	3.07	12	3.19	12	3.31	12	3.43	12	3.55	12	4.07	14	4.21	14	4.35	14	4.49	14	5.03	15	5.18				
7	4.22	15	4.37	15	4.52	15	5.07	15	5.22																

13 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	2334454	9723699	2400787	41652998	10284152	42836576	30
31	2337282	9723015	2403864	41599685	10284871	42784738	29
32	2340110	9722330	2406941	41546501	10285591	42733029	28
33	2342938	9721658	2410019	41493446	10286312	42681449	27
34	2345766	9720975	2413097	41440519	10287034	42629996	26
35	2348594	9720293	2416176	41387719	10287757	42578671	25
36	2351421	9719609	2419255	41335046	10288481	42527474	24
37	2354248	9718925	2422334	41282499	10289206	42476402	23
38	2357075	9718240	2425414	41230079	10289932	42425457	22
39	2359902	9717554	2428494	41177784	10290658	42374637	21
40	2362729	9716867	2431575	41125614	10291385	42323943	20
41	2365555	9716179	2434656	41073569	10292113	42273373	19
42	2368381	9715491	2437737	41021649	10292842	42222928	18
43	2371207	9714802	2440819	40969852	10293572	42172606	17
44	2374033	9714112	2443901	40918178	10294303	42122408	16
45	2376859	9713421	2446984	40866627	10295035	42072333	15
46	2379684	9712729	2450067	40815199	10295768	42022380	14
47	2382510	9712036	2453151	40763892	10296502	41972549	13
48	2385335	9711343	2456235	40712707	10297237	41922840	12
49	2388159	9710649	2459320	40661643	10297973	41873252	11
50	2390984	9709954	2462405	40610700	10298710	41823785	10
51	2393808	9709258	2465491	40559877	10299448	41774438	9
52	2396633	9708561	2468577	40509174	10300187	41725210	8
53	2399457	9707863	2471663	40458590	10300927	41676102	7
54	2402280	9707165	2574750	40408125	10301668	41627114	6
55	2405104	9706466	2477837	40357779	10302410	41578243	5
56	2407927	9705766	2480925	40307550	10303153	41529491	4
57	2410751	9705065	2484013	40257440	10303897	41480856	3
58	2413574	9704363	2487102	40207446	10304642	41432339	2
59	2416396	9703660	2490191	40157570	10305388	41383939	1
60	2419219	9702957	2493280	40107809	10306135	41335655	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

76 DEGREES.

Latitude 27 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.21	1	0.20	1	0.19	2	0.17	2	0.15	2	0.13	1	0.12	1	0.11	1	0.10	2	00.8	2	00.6	2	00.4	1	00.3
2	0.43	3	0.40	3	0.37	3	0.34	3	0.31	3	0.28	3	0.25	3	0.22	3	0.19	3	0.16	4	0.12	3	00.9	2	00.7
3	1.07	4	1.03	4	0.59	4	0.55	5	0.50	5	0.45	5	0.40	5	0.35	5	0.30	5	0.25	5	0.20	7	0.13	3	0.10
4	1.38	6	1.32	6	1.26	7	1.19	7	1.12	7	1.05	7	0.58	7	0.51	7	0.44	7	0.37	8	0.29	8	0.21	6	0.15
5	2.17	9	2.08	9	1.59	9	1.50	9	1.41	9	1.32	10	1.22	10	1.12	10	1.02	10	0.52	10	0.42	10	0.32	9	0.23
6	3.10	11	2.59	12	2.47	12	2.35	12	2.23	12	2.11	13	1.58	13	1.45	14	1.31	14	1.17	14	1.03	16	0.47	13	0.34
7	4.25	14	4.11	15	3.56	15	3.41	15	3.26	15	3.11	17	2.54	18	2.36	18	2.18	18	2.00	18	1.42	23	1.19	20	0.59
W E	6.00	16	5.44	16	5.28	16	5.12	16	4.56	17	4.39	20	4.19	20	3.59	20	3.39	20	3.19	21	2.58	26	2.30	25	2.05
1											6.21	18	6.03	18	5.45	18	5.27	18	5.09	18	4.51	23	4.28	19	4.09
2																					6.42	16	6.26	13	6.13

13 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.3681853	9.9878315	9.3803537	10.6196463	10.0121685	10.6318147	30
31	9.3687111	9.9878012	9.3809100	10.6190900	10.0121988	10.6312889	29
32	9.3692363	9.9877708	9.3814655	10.6185345	10.0122292	10.6307637	28
33	9.3697608	9.9877404	9.3820205	10.6179795	10.0122596	10.6302392	27
34	9.3702847	9.9877099	9.3825748	10.6174252	10.0122901	10.6297153	26
35	9.3708079	9.9876794	9.3831285	10.6168715	10.0123206	10.9291921	25
36	9.3713304	9.9876488	9.3836816	10.6163184	10.0123512	10.6286696	24
37	9.3718523	9.9876183	9.3842340	10.6157660	10.0123817	10.6281477	23
38	9.3723735	9.9875876	9.3847858	10.6152142	10.0124124	10.6276265	22
39	9.3728940	9.9875570	9.3853370	10.6146630	10.0124430	10.6271060	21
40	9.3734139	9.9875263	9.3858876	10.6141124	10.0124737	10.6265861	20
41	9.3739331	9.9874955	9.3864376	10.6135624	10.0125045	10.6260669	19
42	9.3744517	9.9874648	9.3869869	10.6130131	10.0125352	10.6255483	18
43	9.3749696	9.9874339	9.3875356	10.6124644	10.0125661	10.6250304	17
44	9.3754868	9.9874031	9.3880837	10.6119163	10.0125969	10.6245132	16
45	9.3760034	9.9873722	9.3886312	10.6113688	10.0126278	10.6239966	15
46	9.3765194	9.9873413	9.3891781	10.6108219	10.0126587	10.6234806	14
47	9.3770347	9.9873103	9.3897244	10.6102756	10.0126897	10.6229653	13
48	9.3775493	9.9872793	9.3902700	10.6097300	10.0127207	10.6224507	12
49	9.3780633	9.9872482	9.3908151	10.6091849	10.0127518	10.6219367	11
50	9.3785767	9.9872171	9.3913595	10.6086405	10.0127829	10.6214233	10
51	9.3790894	9.9871860	9.3919034	10.6080966	10.0128140	10.6209106	9
52	9.3796015	9.9871549	9.3924466	10.6075534	10.0128451	10.6203985	8
53	9.3801129	9.9871236	9.3929893	10.6070107	10.0128764	10.6198871	7
54	9.3806237	9.9870924	9.3935313	10.6064687	10.0129076	10.6193763	6
55	9.3811339	9.9870611	9.3940727	10.6059273	10.0129389	10.6188661	5
56	9.3816434	9.9870298	9.3946136	10.6053864	10.0129702	10.6183566	4
57	9.3821523	9.9869984	9.3951538	10.6048462	10.0130016	10.6178477	3
58	9.3826605	9.9869670	9.3956935	10.6043065	10.0130330	10.6173395	2
59	9.3831682	9.9869356	9.3962326	10.6037674	10.0130644	10.6168318	1
60	9.3836752	9.9869041	9.3967711	10.6032289	10.0130959	10.6163248	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

76 DEGREES.

Latitude 27 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.21	1	0.22	1	0.23	1	0.24	2	0.26	2	0.28	1	0.29	1	0.30	2	0.32	2	0.34	2	0.36	1	0.37	1	0.38
2	0.43	2	0.45	3	0.48	3	0.51	3	0.54	3	0.57	3	1.00	3	1.03	3	1.06	3	1.09	3	1.12	3	1.16	3	1.19
3	1.07	4	1.11	4	1.15	5	1.20	5	1.25	5	1.30	5	1.35	5	1.40	5	1.45	5	1.50	5	1.55	6	2.01	4	2.05
4	1.38	6	1.44	6	1.50	7	1.57	7	2.04	7	2.11	7	2.18	7	2.25	7	2.32	7	2.39	7	2.46	8	2.54	6	3.00
5	2.17	9	2.26	9	2.35	9	2.44	9	2.53	9	3.02	10	3.12	10	3.22	10	3.32	10	3.42	10	3.52	9	4.01	9	4.10
6	3.10	12	3.22	12	3.34	12	3.46	12	3.58	12	4.10	13	4.23	13	4.36	14	4.50	14	5.04	14	5.18				
7	4.25	14	4.39	15	4.54	15	5.09	15	5.24	15	5.39														

14 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	2419219	9702957	2493280	40107809	10306135	41335655	60
1	2422041	9702253	2496370	40058165	10306883	41287487	59
2	2424863	9701548	2499460	40008636	10307632	41239435	58
3	2427685	9700842	2502551	39959223	10308382	41191498	57
4	2430507	9700135	2505642	39909924	10309133	41143675	56
5	2433329	9699428	2508734	39860739	10309885	41095967	55
6	2436150	9698720	2511826	39811669	10310638	41048374	54
7	2438971	9698011	2514919	39762712	10311392	41000893	53
8	2441792	9697301	2518012	39713868	10312147	40953526	52
9	2444613	9696590	2521106	39665137	10312903	40906272	51
10	2447433	9695879	2524200	39616518	10313660	40859130	50
11	2450254	9695167	2527294	39568011	10314418	40812100	49
12	2453074	9694454	2530389	39519615	10315177	40765181	48
13	2455894	9693740	2533484	39471331	10315936	40718374	47
14	2458713	9693025	2536580	39423157	10316697	40671677	46
15	2461533	9692309	2539676	39375094	10317459	40625091	45
16	2464352	9691592	2542773	39327141	10318222	40578615	44
17	2467171	9690875	2545870	39279297	10318985	40532249	43
18	2469990	9690157	2548968	39231563	10319750	40485992	42
19	2472809	9689438	2552066	39183937	10320516	40439844	41
20	2475627	9688718	2555165	39136420	10321282	40393804	40
21	2478445	9687998	2558264	39089011	10322050	40347872	39
22	2481263	9687277	2561363	39041710	10322818	40302048	38
23	2484081	9686555	2564463	38994516	10323588	40256332	37
24	2486899	9685832	2567563	38947429	10324359	40210722	36
25	2489716	9685108	2570664	38900448	10325130	40165219	35
26	2492533	9684383	2573766	38853574	10325903	40119823	34
27	2495350	9683657	2576868	38806805	10326676	40074532	33
28	2498167	9682931	2579970	38760142	10327451	40029347	32
29	2500984	9682204	2583073	38713584	10328227	39984267	31
30	2503800	9681476	2586176	38667131	10329003	39939292	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

75 DEGREES.

Latitude 28 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.21	1	0.20	1	0.19	1	0.18	2	0.16	2	0.14	1	0.13	1	0.12	1	0.11	2	00.9	2	00.7	2	00.5	1	00.4
2	0.44	2	0.42	3	0.39	3	0.36	3	0.33	3	0.30	3	0.27	3	0.24	3	0.21	3	0.18	4	0.14	3	0.11	3	00.8
3	1.10	4	1.06	4	1.02	5	0.57	5	0.52	5	0.47	5	0.42	5	0.37	5	0.32	5	0.27	5	0.22	6	0.16	4	0.12
4	1.41	6	1.35	6	1.29	7	1.22	7	1.15	7	1.08	6	1.02	6	0.56	7	0.49	7	0.42	7	0.35	10	0.25	6	0.19
5	2.20	8	2.12	9	2.03	9	1.54	9	1.45	9	1.36	9	1.27	9	1.18	10	1.08	10	0.58	10	0.48	11	0.37	9	0.28
6	3.14	11	3.03	11	2.52	11	2.41	12	2.29	12	2.17	13	2.04	13	1.51	13	1.38	13	1.25	14	1.11	16	0.55	12	0.43
7	4.28	14	4.14	14	4.00	14	3.46	14	3.32	15	3.17	17	3.00	17	2.43	17	2.26	17	2.09	17	1.52	21	1.31	81	1.13
W E	6.00	15	5.45	15	5.30	15	5.15	16	4.59	16	4.43	91	4.24	19	4.05	19	3.46	19	3.27	20	3.07	25	2.42	22	2.20
1											6.21	17		17		17		17		17	4.56		4.34		4.16
2																					6.42		6.27		6.14

14 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.3836752	9.9869041	9.3967711	10.6032289	10.0130959	10.6163248	60
1	9.3841815	9.9868726	9.3973089	10.6026911	10.0131274	10.6158185	59
2	9.3846873	9.9868410	9.3978463	10.6021537	10.0131590	10.6153127	58
3	9.3851924	9.9868094	9.3983830	10.6016170	10.0131906	10.6148076	57
4	9.3856969	9.9867778	9.3989191	10.6010809	10.0132222	10.6143031	56
5	9.3862008	9.9867461	9.3994547	10.6005453	10.0132539	10.6137992	55
6	9.3867040	9.9867144	9.3999896	10.6000104	10.0132856	10.6132960	54
7	9.3872067	9.9866827	9.4005240	10.5994760	10.0133173	10.6127933	53
8	9.3877087	9.9866509	9.4010578	10.5989422	10.0133491	10.6122913	52
9	9.3882101	9.9866191	9.4015910	10.5984090	10.0133809	10.6117899	51
10	9.3887109	9.9865872	9.4021237	10.5978763	10.0134128	10.6112891	50
11	9.3892111	9.9865553	9.4026558	10.5973442	10.0134447	10.6107889	49
12	9.3897106	9.9865233	9.4031873	10.5968127	10.0134767	10.6102894	48
13	9.3902096	9.9864913	9.4037182	10.5962818	10.0135087	10.6097904	47
14	9.3907079	9.9864593	9.4042486	10.5957514	10.0135407	10.6092921	46
15	9.3912057	9.9864273	9.4047784	10.5952216	10.0135727	10.6087943	45
16	9.3917028	9.9863952	9.4053076	10.5946924	10.0136048	10.6082972	44
17	9.3921993	9.9863630	9.4058363	10.5941637	10.0136370	10.6078007	43
18	9.3926952	9.9863308	9.4063644	10.5936356	10.0136692	10.6073048	42
19	9.3931905	9.9862986	9.4068919	10.5931081	10.0137014	10.6068095	41
20	9.3936852	9.9862663	9.4074189	10.5925811	10.0137337	10.6063148	40
21	9.3941794	9.9862340	9.4079453	10.5920547	10.0137660	10.6058206	39
22	9.3946729	9.9862017	9.4084712	10.5915288	10.0137983	10.6053271	38
23	9.3951658	9.9861693	9.4089965	10.5910035	10.0138307	10.6048342	37
24	9.3956581	9.9861369	9.4095212	10.5904788	10.0138631	10.6043419	36
25	9.3961499	9.9861045	9.4100454	10.5899546	10.0138955	10.6038501	35
26	9.3966410	9.9860720	9.4105690	10.5894310	10.0139280	10.6033590	34
27	9.3971315	9.9860394	9.4110921	10.5889079	10.0139606	10.6028685	33
28	9.3976215	9.9860069	9.4116146	10.5883854	10.0139931	10.6023785	32
29	9.3981109	9.9859742	9.4121366	10.5878634	10.0140258	10.6018891	31
30	9.3985996	9.9859416	9.4126581	10.5873419	10.0140584	10.6014004	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

75 DEGREES.

Latitude 28 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.21	1	0.22	1	0.23	1	0.24	2	0.26	2	0.28	1	0.29	1	0.30	2	0.32	2	0.34	2	0.36	2	0.38	1	0.39
2	0.44	2	0.46	3	0.49	3	0.52	3	0.55	3	0.58	3	6.01	3	6.04	3	6.07	3	6.10	4	1.14	3	1.17	3	1.20
3	1.10	4	1.14	4	1.18	4	1.22	5	1.27	5	1.32	5	1.37	5	1.42	5	1.47	5	1.52	5	1.57	5	2.02	4	2.06
4	1.41	6	1.47	6	1.53	6	1.59	7	2.06	7	2.13	6	2.19	7	2.26	7	2.33	7	2.40	7	2.47	9	2.56	6	3.02
5	2.20	8	2.28	9	2.37	9	2.46	9	2.55	9	3.04	9	3.13	10	3.23	10	3.33	10	3.43	10	3.53	11	4.04	9	4.13
6	3.14	11	3.25	11	3.36	12	3.48	12	4.00	12	4.12	13	4.25	13	4.38	13	4.51	13	5.04	14	5.18				
7	4.28	14	4.42	14	4.56	14	5.10	14	5.24	15	5.39														
W E																									

14 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	2503800	9681476	2586176	38667131	10329003	39939292	30
31	2506616	9680747	2589280	38620782	10329781	39894421	29
32	2509432	9680018	2592384	38574537	10330559	39849654	28
33	2512248	9679288	2595488	38528396	10331339	39804991	27
34	2515063	9678557	2598593	38482358	10332119	39760431	26
35	2517879	9677825	2601699	38436424	10332901	39715975	25
36	2520694	9677092	2604805	38390591	10333683	39671621	24
37	2523508	9676358	2607911	38344861	10334467	39627369	23
38	2526323	9675623	2611018	38299233	10335251	39583219	22
39	2529137	9674888	2614126	38253707	10336037	39539171	21
40	2531952	9674152	2617234	38208281	10336823	39495224	20
41	2534766	9673415	2620342	38162957	10337611	39451379	19
42	2537579	9672677	2623451	38117733	10338399	39407633	18
43	2540393	9671938	2626560	38072609	10339188	39363988	17
44	2543206	9671199	2629670	38027585	10339979	39320443	16
45	2546019	9670459	2632780	37982661	10340770	39276997	15
46	2548832	9669718	2635891	37937835	10341563	39233651	14
47	2551645	9668976	2639002	37893109	10342356	39190403	13
48	2554458	9668233	2642114	37848481	10343151	39147254	12
49	2557270	9667490	2645226	37803951	10343946	39104203	11
50	2560082	9666745	2648339	37759519	10344743	39061250	10
51	2562894	9666001	2651452	37715185	10345540	[illegible]	9
52	2565705	9665255	2654566	37670947	1[illegible]6338	3897[illegible]	[illegible]
53	2568517	9664508	2657680	376268[illegible]7	10[illegible]138	389[illegible]	[illegible]
54	2571328	9663760	2660794	37582763	10347938	3890[illegible]	[illegible]
55	2574139	9663012	2663909	37538815	10348740	388479[illegible]	[illegible]
56	2576950	9662263	2667025	37494963	10349542	3880[illegible]70	4
57	2579760	9661513	2670141	37451207	10350346	38763293	3
58	2582570	9660762	2673257	37407546	10351150	38721112	2
59	2585381	9660010	2676374	37363980	10351955	38679027	1
60	2588190	9659258	2979492	37320508	10352762	38637033	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

75 DEGREES.

Latitude 29 Deg. 00 Min. North Declination.

	0	d	2	d	4	d	6	d	8	d	10	d	12	d	14	d	16	d	18	d	20	d	22	d	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m	m.	h. m.	m.	h. m	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.22	1	0.21	1	0.20	1	0.19	2	0.17	2	0.15	1	0.14	1	0.13	1	0.12	2	0.10	2	0.08	2	0.06	1	0.05
2	0.45	2	0.43	3	0.40	3	0.37	3	0.34	3	0.31	3	0.28	3	0.25	3	0.22	3	0.19	3	0.16	4	0.12	2	0.10
3	1.12	4	1.08	4	1.04	5	0.59	5	0.54	5	0.49	4	0.45	5	0.40	5	0.35	5	0.30	5	0.25	5	0.20	4	0.16
4	1.43	6	1.37	6	1.31	6	1.25	6	1.19	7	1.12	7	1.05	7	0.58	7	0.51	7	0.44	7	0.37	8	0.29	6	0.23
5	2.13	8	2.05	8	1.57	8	1.49	9	1.40	9	1.41	9	1.32	9	1.23	10	1.13	10	1.03	10	0.53	11	0.42	8	0.34
6	3.34	14	3.20	14	3.06	14	2.52	15	2.37	15	2.22	12	2.10	13	1.57	13	1.44	13	1.31	13	1.18	15	1.03	12	0.51
7	4.14	10	4.04	10	3.54	10	3.44	11	3.33	11	3.22	16	3.06	16	2.50	16	2.34	16	2.18	17	2.01	20	1.41	17	1.24
W E	5.42	11	5.31	11	5.20	11	5.09	11	4.58	12	4.46	18	4.28	18	4.10	18	3.52	18	3.34	18	3.16	23	2.53	20	2.33
1											5.21	16	6.05	16	5.49	[illegible]	5.33	[illegible]	5.17	17	5.00	20	4.40	17	4.23
2																					6.42	15	6.27	12	6.15

14 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.3985896	9.9859416	9.4126581	10.5873419	10.0140584	10.6014004	30
31	9.3990878	9.9859089	9.4131789	10.5868211	10.0140911	10.6009122	29
32	9.3995754	9.9858762	9.4136993	10.5863007	10.0141238	10.6004246	28
33	9.4000625	9.9858434	9.4142191	10.5857809	10.0141566	10.5999375	27
34	9.4005489	9.9858106	9.4147383	10.5852617	10.0141894	10.5994511	26
35	9.4010348	9.9857777	9.4152570	10.5847430	10.0142223	10.5989652	25
36	9.4015201	9.9857449	9.4157752	10.5842248	10.0142551	10.5984799	24
37	9.4020048	9.9857119	9.4162928	10.5837072	10.0142881	10.5979952	23
38	9.4024889	9.9856790	9.4168099	10.5831901	10.0143210	10.5975111	22
39	9.4029734	9.9856460	9.4173265	10.5826735	10.0143540	10.5970276	21
40	9.4034574	9.9856129	9.4178425	10.5821575	10.0143871	10.5965446	20
41	9.4039378	9.9855798	9.4183580	10.5816420	10.0144202	10.5960622	19
42	9.4044196	9.9855467	9.4188729	10.5811271	10.0144533	10.5955804	18
43	9.4049009	9.9855135	9.4193874	10.5806126	10.0144865	10.5950991	17
44	9.4053816	9.9854803	9.4199013	10.5800987	10.0145197	10.5946184	16
45	9.4058617	9.9854471	9.4204146	10.5795854	10.0145529	10.5941383	15
46	9.4063413	9.9854138	9.4209275	10.5790725	10.0145862	10.5936587	14
47	9.4068203	9.9853805	9.4214398	10.5785602	10.0146195	10.5931797	13
48	9.4072987	9.9853471	9.4219515	10.5780485	10.0146529	10.5927013	12
49	9.4077765	9.9853138	9.4224628	10.5775372	10.0146862	10.5922234	11
50	9.4082539	9.9852803	9.4229735	10.5770265	10.0147197	10.5917461	10
51	9.4087306	9.9852468	9.4234838	10.5765162	10.0147532	10.5912694	9
52	9.4092068	9.9852133	9.4239935	10.5760065	10.0147867	10.5907932	8
53	9.4096824	9.9851798	9.4245026	10.5754974	10.0148202	10.5903176	7
54	9.4101575	9.9851462	9.4250113	10.5749887	10.0148538	10.5898425	6
55	9.4106320	9.9851125	9.4255194	10.5744806	10.0148875	10.5893680	5
56	9.4111059	9.9850789	9.4260271	10.5739729	10.0149211	10.5888941	4
57	9.4115793	9.9850452	9.4265342	10.5734658	10.0149548	10.5884207	3
58	9.4120522	9.9850114	9.4270408	10.5729592	10.0149886	10.5879478	2
59	9.4125245	9.9849776	9.4275469	10.5724531	10.0150224	10.5874755	1
60	9.4129962	9.9849438	9.4280525	10.5719475	10.0150562	10.5870038	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

75 DEGREES.

Latitude 29 Deg. 00 Min. South Declination.

	0	d.	2	d	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m	h m.	m.	h. m	m.	h. m	m.	h. m.	m.	h. m.	m.	h m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.22	1	0.23	1	0.24	1	0.25	2	0.27	2	0.29	1	0.30	1	0.31	2	0.33	2	0.35	2	0.37	1	0.38	1	0.39
2	0.45	3	0.48	3	0.51	3	0.54	3	0.57	3	1.00	3	1.03	3	1.06	3	1.09	3	1.12	3	1.15	3	1.18	3	1.21
3	1.12	4	1.16	4	1.20	4	1.24	5	1.29	5	1.34	5	1.39	5	1.44	5	1.49	5	1.54	5	1.59	5	2.04	4	2.08
4	1.43	6	1.49	6	1.55	6	2.01	7	2.08	7	2.15	7	2.22	7	2.29	7	2.36	7	2.43	7	2.50	8	2.58	6	3.04
5	2.24	8	2.32	8	2.40	9	2.49	9	2.58	9	3.07	9	3.16	9	3.25	10	3.35	10	3.45	10	3.55	10	4.05	9	4.11
6	3.18	11	3.29	11	3.40	11	3.51	11	4.02	12	4.14	12	4.26	12	4.38	12	4.50								
7	4.31	13	4.44	13	4.57	14	5.11	14	5.25	14	5.39														
W E																									

15 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	2588190	9659258	2679492	37320508	10352762	38637033	60
1	2591000	9658505	2682610	37277131	10353569	38595135	59
2	2593810	9657751	2685728	37233847	10354378	38553332	58
3	2596619	9656996	2688847	37190658	10355187	38511622	57
4	2599428	9656240	2691967	37147561	10355998	38470005	56
5	2602237	9655483	2695087	37104558	10356809	38428482	55
6	2605045	9654726	2698207	37061648	10357621	38387051	54
7	2607853	9653968	2701328	37018830	10358435	38345713	53
8	2610661	9653209	2704449	36976103	10359249	38304467	52
9	2613469	9652449	2707571	36933469	10360065	38263313	51
10	2616277	9651688	2710693	36890927	10360881	38222251	50
11	2619085	9650927	2713816	36848475	10361699	38181280	49
12	2621892	9650165	2716940	36806115	10362517	38140399	48
13	2624699	9649402	2720064	36763845	10363337	38099610	47
14	2627506	9648638	2723188	36721665	10364157	38058911	46
15	2630312	9647873	2726313	36679575	10364979	38018301	45
16	2633118	9647107	2729438	36637575	10365801	37977782	44
17	2635924	9646341	2732564	36595665	10366625	37937352	43
18	2638730	9645574	2735690	36553844	10367449	37897011	42
19	2641536	9644806	2738817	39512111	10368275	37856760	41
20	2644342	9644037	2741944	36470467	10369101	37816596	40
21	2647147	9643267	2745072	36428911	10369929	37776522	39
22	2649952	9642497	2748201	36387444	10370757	37736535	38
23	2652757	9641726	2751330	36346064	10371587	37696636	37
24	2655561	9640954	2754459	36304771	10372417	37656824	36
25	2658365	9640181	2757589	36263566	10373249	37617100	35
26	2661169	9639407	2760719	36222447	10374082	37577462	34
27	2663973	9638633	2763850	36181415	10374915	37537911	33
28	2666777	9637858	2766981	36140469	10375750	37498447	32
29	2669581	9637082	2770113	36099609	10376585	37459068	31
30	2672384	9636305	2773245	36058835	10377422	37419775	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co Secant.	N. Secant.	M

74 DEGREES.

Latitude 30 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.23	1	0.22	1	0.25	1	0.20	2	0.18	2	0.16	1	0.15	1	0.14	2	0.12	2	0.10	2	00.8	1	00.7	1	00.6
2	0.47	2	0.45	3	0.42	3	0.35	3	0.32	3	0.33	3	0.30	3	0.27	3	0.24	3	0.21	4	0.17	3	0.14	2	0.12
3	1.14	4	1.10	4	1.06	4	1.02	5	0.57	5	0.52	4	0.48	5	0.43	5	0.38	5	0.33	5	0.28	5	0.23	4	0.19
4	1.46	6	1.40	6	1.34	6	1.28	6	1.22	7	1.15	6	1.09	7	1.02	7	0.55	7	0.48	7	0.41	8	0.33	6	0.27
5	2.27	8	2.19	8	2.11	8	2.03	9	1.54	9	1.45	9	1.36	9	1.27	9	1.18	10	1.08	10	0.58	10	0.48	8	0.40
6	3.21	10	3.11	11	3.00	11	2.49	11	2.38	11	2.27	12	2.15	12	2.03	12	1.51	13	1.38	13	1.25	14	1.11	12	0.59
7	4.33	13	4.20	13	4.07	13	3.54	13	3.41	14	3.27	15	3.12	15	2.57	15	2.42	16	2.26	16	2.10	19	1.51	16	1.35
W E	6.02	16	5.46	14	5.32	14	5.18	14	5.04	15	4.49	17	4.32	17	4.15	17	3.58	17	3.41	17	3.24	22	3.02	18	2.44
1											6.21	13	6.06	13	5.55	13	5.41	14	5.27	14	5.03	18	4.45	16	4.29
2																					6.42	14	6.28	11	6.17

15 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.4129962	9.9849438	9.4280525	10.5719475	10.0150562	10.5870038	60
1	9.4134674	9.9849099	9.4285575	10.5714425	10.0150901	10.5865326	59
2	9.4139381	9.9848760	9.4290621	10.5709379	10.0151240	10.5860619	58
3	9.4144082	9.9848420	9.4295661	10.5704339	10.0151580	10.5855918	57
4	9.4148778	9.9848081	9.4300697	10.5699303	10.0151919	10.5851222	56
5	9.4153468	9.9847740	9.4305727	10.5694273	10.0152260	10.5846532	55
6	9.4158152	9.9847400	9.4310753	10.5689247	10.0152600	10.5841848	54
7	9.4162832	9.9847059	9.4315773	10.5684227	10.0152941	10.5837168	53
8	9.4167506	9.9846717	9.4320789	10.5679211	10.0153283	10.5832494	52
9	9.4172174	9.9846375	9.4325799	10.5674201	10.0153625	10.5827826	51
10	9.4176837	9.9846033	9.4330804	10.5669196	10.0153967	10.5823163	50
11	9.4181495	9.9845690	9.4335805	10.5664195	10.0154310	10.5818505	49
12	9.4186148	9.9845347	9.4340800	10.5659200	10.0154653	10.5813852	48
13	9.4190795	9.9845004	9.4345791	10.5654209	10.0154996	10.5809205	47
14	9.4195436	9.9844660	9.4350776	10.5649224	10.0155340	10.5804564	46
15	9.4200073	9.9844316	9.4355757	10.5644243	10.0155684	10.5799927	45
16	9.4204704	9.9843971	9.4360733	10.5639267	10.0156029	10.5795296	44
17	9.4209330	9.9843626	9.4365704	10.5634296	10.0156374	10.5790670	43
18	9.4213950	9.9843281	9.4370670	10.5629330	10.0156719	10.5786050	42
19	9.4218566	9.9842935	9.4375631	10.5624369	10.0157065	10.5781434	41
20	9.4223176	9.9842589	9.4380587	10.5619413	10.0157411	10.5776824	40
21	9.4227780	9.9842242	9.4385538	10.5614462	10.0157758	10.5772220	39
22	9.4232380	9.9841895	9.4390485	10.5609515	10.0158105	10.5767620	38
23	9.4236974	9.9841548	9.4395426	10.5604574	10.0158452	10.5763026	37
24	9.4241563	9.9841200	9.4400363	10.5599637	10.0158800	10.5758437	36
25	9.4246147	9.9840852	9.4405295	10.5594705	10.0159148	10.5753853	35
26	9.4250726	9.9840503	9.4410222	10.5589778	10.0159497	10.5749274	34
27	9.4255299	9.9840154	9.4415145	10.5584855	10.0159846	10.5744701	33
28	9.4259867	9.9839805	9.4420062	10.5579938	10.0160195	10.5740133	32
29	9.4264430	9.9839455	9.4424975	10.5575025	10.0160545	10.5735570	31
30	9.4268988	9.9839105	9.4429883	10.5570117	10.0160895	10.5731012	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

74 DEGREES.

Latitude 30 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.23	1	0.24	1	0.25	1	0.26	2	0.28	2	0.30	1	0.31	1	0.32	1	0.33	2	0.35	2	0.37	2	0.39	1	0.40
2	0.47	2	0.49	3	0.52	3	0.55	3	0.58	3	1.01	3	1.04	3	1.07	3	1.10	3	1.13	3	1.16	3	1.19	3	1.22
3	1.14	4	1.18	4	1.22	4	1.26	5	1.31	5	1.36	4	1.40	5	1.45	5	1.50	5	1.55	5	2.00	5	2.05	4	2.09
4	1.46	6	1.52	6	1.58	6	2.04	7	2.11	7	2.18	6	2.24	7	2.31	7	2.38	7	2.45	7	2.52	7	2.59	6	3.05
5	2.27	8	2.35	8	2.43	8	2.51	9	3.00	9	3.09	9	3.18	9	3.27	9	3.36	10	3.46	10	3.56	10	4.06	8	4.14
6	3.21	11	3.32	11	3.43	11	3.54	11	4.05	11	4.16	11	4.27	11	4.38	11	4.49								
7	4.33	13	4.46	13	4.59	13	5.12	13	5.25	14	5.39														
W E																									

15 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Targ.	N. Secant.	N. Co-Secant	
30	2672384	9636305	2773245	36058835	10377422	37419775	30
31	2675187	9635527	2776378	36018146	10378260	37380568	29
32	2677989	9634748	2779512	35977543	10379098	37341446	28
33	2680792	9633969	2782646	35937024	10379938	37302409	27
34	2683594	9633189	2785780	35896590	10380779	37263457	26
35	2686396	9632408	2788915	35856241	10381621	37224589	25
36	2689198	9631626	2792050	35815975	10382463	37185805	24
37	2692000	9630843	2795186	35775794	10383307	37147105	23
38	2694801	9630059	2798322	35735696	10384152	37108489	22
39	2697602	9629275	2801459	35695681	10384998	37069956	21
40	2700403	9628490	2804597	35655749	10385844	37031506	20
41	2703204	9627704	2807735	35615900	10386692	36993139	19
42	2706004	9626917	2810873	35576133	10387541	36954854	18
43	2708805	9626130	2814012	35536449	10388391	36916652	17
44	2711605	9625342	2817152	35496846	10389242	36878532	16
45	2714404	9624553	2820292	35457325	10390094	36840493	15
46	2717204	9623763	2823432	35417886	10390947	36802536	14
47	2720003	9622972	2826573	35378528	10391800	36764660	13
48	2722802	9622180	2829715	35339251	10392655	36726865	12
49	2725601	9621387	2832857	35300054	10393511	36689151	11
50	2728400	9620594	2835999	35260938	10394368	36651518	10
51	2731198	9619800	2839142	35221902	10395226	36613964	9
52	2733996	9619005	2842286	35182946	10396085	36576491	8
53	2736794	9618209	2845430	35144070	10396945	36539097	7
54	2739592	9617413	2848575	35105273	10397806	36501783	6
55	2742390	9616616	2851720	35066555	10398669	36464548	5
56	2745187	9615818	2854866	35027916	10399532	36427392	4
57	2747984	9615019	2858012	34989356	10400396	36390315	3
58	2750781	9614219	2861159	34950874	10401261	36353316	2
59	2753578	9613418	2864306	34912470	10402127	36316395	1
60	2756374	9612617	2867454	34874144	10402994	36279553	0
	N. Co-Sine.	N. Sine.	N.Co-Targ.	N. Targent.	N.Co Secant.	N. Secant.	M

74 DEGREES.

Latitude 31 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d	8	d	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.23	1	0.22	1	0.21	1	0.20	1	0.19	2	0.17	1	0.16	1	0.15	2	0.13	2	0.11	2	00.9	1	00.8	1	00.7
2	0.45	2	0.46	3	0.43	3	0.40	3	0.37	3	0.34	3	0.31	3	0.28	3	0.25	3	0.22	3	0.19	3	0.16	3	0.13
3	1.16	4	1.12	4	1.08	4	1.04	5	0.59	5	0.54	4	0.50	4	0.46	5	0.41	5	0.36	5	0.31	6	0.25	4	0.21
4	1.49	6	1.43	6	1.37	6	1.31	6	1.25	7	1.18	6	1.12	6	1.06	7	0.59	7	0.52	7	0.45	8	0.37	5	0.32
5	2.30	8	2.22	8	2.14	8	2.06	8	1.58	9	1.49	9	1.40	9	1.31	9	1.22	9	1.13	9	1.04	10	0.54	6	0.46
6	3.25	10	3.15	10	3.05	11	2.54	11	2.43	11	2.32	12	2.20	12	2.08	12	1.56	12	1.44	12	1.32	14	1.18	11	1.07
7	4.36	12	4.24	13	4.11	13	3.58	13	3.45	13	3.32	14	3.18	15	3.03	15	2.48	15	2.33	15	2.18	18	2.00	14	1.46
W E	6.00	13	5.47	13	5.34	14	5.20	14	5.06	14	4.52	16	4.36	16	4.20	16	4.04	16	3.48	17	3.31	20	3.11	16	2.55
1											6.21	14	5.07	15	5.52	15	5.37	15	5.22	15	5.07	16	4.49	14	4.35
2																					6.43		6.29		6.18

15 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.4268988	9.9839105	9.4429883	10.5570117	10.0160895	10.5731012	30
31	9.4273541	9.9838755	9.4434786	10.5565214	10.0161245	10.5726459	29
32	9.4278089	9.9838404	9.4439685	10.5560315	10.0161596	10.5721911	28
33	9.4282631	9.9838052	9.4444579	10.5555421	10.0161948	10.5717369	27
34	9.4287169	9.9837701	9.4449468	10.5550532	10.0162299	10.5712831	26
35	9.4291701	9.9837348	9.4454352	10.5545648	10.0162652	10.5708299	25
36	9.4296228	9.9836996	9.4459232	10.5540768	10.0163004	10.5703772	24
37	9.4300750	9.9836643	9.4464107	10.5535893	10.0163357	10.5699250	23
38	9.4305267	9.9836290	9.4468978	10.5531022	10.0163710	10.5694733	22
39	9.4309779	9.9835936	9.4473843	10.5526157	10.0164064	10.5690221	21
40	9.4314286	9.9835582	9.4478704	10.5521296	10.0164418	10.5685714	20
41	9.4318788	9.9835227	9.4483561	10.5516439	10.0164773	10.5681212	19
42	9.4323285	9.9834872	9.4488413	10.5511587	10.0165128	10.5676715	18
43	9.4327777	9.9834517	9.4493260	10.5506740	10.0165483	10.5672223	17
44	9.4332264	9.9834161	9.4498102	10.5501898	10.0165839	10.5667736	16
45	9.4336746	9.9833805	9.4502940	10.5497060	10.0166195	10.5663254	15
46	9.4341223	9.9833449	9.4507774	10.5492226	10.0166551	10.5658777	14
47	9.4345694	9.9833092	9.4512602	10.5487398	10.0166908	10.5654306	13
48	9.4350161	9.9832735	9.4517427	10.5482573	10.0167265	10.5649839	12
49	9.4354623	9.9832377	9.4522246	10.5477754	10.0167623	10.5645377	11
50	9.4359080	9.9832019	9.4527061	10.5472939	10.0167981	10.5640920	10
51	9.4363532	9.9831661	9.4531872	10.5468128	10.0168339	10.5636468	9
52	9.4367980	9.9831302	9.4536678	10.5463322	10.0168698	10.5632020	8
53	9.4372422	9.9830942	9.4541479	10.5458521	10.0169058	10.5627578	7
54	9.4376859	9.9830583	9.4546276	10.5453724	10.0169417	10.5623141	6
55	9.4381292	9.9830223	9.4551069	10.5448931	10.0169777	10.5618708	5
56	9.4385719	9.9829862	9.4555857	10.5444143	10.0170138	10.5614281	4
57	9.4390142	9.9829501	9.4560641	10.5439359	10.0170499	10.5609858	3
58	9.4394560	9.9829140	9.4565420	10.5434580	10.0170860	10.5605440	2
59	9.4398973	9.9828778	9.4570194	10.5429806	10.0171222	10.5601027	1
60	9.4403381	9.9828416	9.4574964	10.5425036	10.0171586	10.5596619	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

74 DEGREES.

Latitude 31 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.23	1	0.24	1	0.25	1	0.26	2	0.28	2	0.30	1	0.31	1	0.32	2	0.34	2	0.36	2	0.38	1	0.39	1	0.40
2	0.48	2	0.50	3	0.53	3	0.56	3	0.59	3	1.02	3	1.05	3	1.08	3	1.11	3	1.14	3	1.17	3	1.20	3	1.23
3	1.16	4	1.20	4	1.24	4	1.28	5	1.33	5	1.38	4	1.42	4	1.46	5	1.51	5	1.56	5	2.01	6	2.07	4	2.11
4	1.49	6	1.55	6	2.01	6	2.07	6	2.13	7	2.20	6	2.26	6	2.32	7	2.39	7	2.46	7	2.53	8	3.01	5	3.06
5	2.30	8	2.38	8	2.46	8	2.54	9	3.03	9	3.12	9	3.21	9	3.30	9	3.39	9	3.48	9	3.57	10	4.07	8	4.15
6	3.25	10	3.35	10	3.45	11	3.56	11	4.07	11	4.18	11	4.29	12	4.41	12	4.53	12	5.05	12	5.17				
7	4.36	12	4.48	12	5.00	12	5.12																		
W E																									

16 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	2756374	9612617	2867454	34874144	10402994	36279553	60
1	2759170	9611815	2870602	34835896	10403863	36242788	59
2	2761965	9611012	2873751	34797726	10404732	36206101	58
3	2764761	9610208	2876900	34759632	10405602	36169490	57
4	2767556	9609403	[illegible]	34721616	10406473	36132957	56
5	2770352	[illegible]	[illegible]	34683676	10407346	36096501	55
6	2773147	9607792	2886352	34645813	10408219	36060121	54
7	2775941	9606985	2889503	[illegible]	10409094	36023818	53
8	2778736	9606177	2892655	34570315	10409969	35987590	52
9	2781530	9605368	2895808	34532679	10410845	35951439	51
10	2784324	9604559	2898961	34495120	10411723	35915363	50
11	2787118	9603749	2902114	34457635	10412601	35879362	49
12	2789911	9602937	[illegible]	34420226	10413481	35843437	48
13	2792704	9602125	2908423	34382891	10414362	35807586	47
14	2795497	9601312	2911578	34345631	10415243	35771810	46
15	2798290	9600498	2914734	34308446	10416126	35736108	45
16	2801083	9599684	2917890	34271334	10417009	35700481	44
17	2803875	9598869	2921047	34234297	10417894	35664928	43
18	2806667	[illegible]	2924205	34197333	10418780	35629448	42
19	2809459	9597236	2927363	34160443	10419667	35594042	41
20	2812251	9596418	2930521	34123626	10420554	35558710	40
21	2815042	9595600	2933680	34086882	10421443	35523450	39
22	2817833	9594781	2936839	34050210	10422333	35488263	38
23	2820624	9593961	2939999	34013612	10423224	35453149	37
24	2823415	9593140	2943160	33977085	10424116	35418107	36
25	2826205	9592318	2946321	33940631	10425009	35383138	35
26	2828995	9591495	2949483	33904249	10425903	35348240	34
27	2831785	9590672	2952645	33867938	10426798	35313414	33
28	2834575	9589848	2955808	33831699	10427694	35278660	32
29	2837364	9589023	2958971	33795531	10428591	35243977	31
30	2840153	9588197	2962135	33759434	10429489	35209365	30
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co-Secant.	N. Secant.	M

73 DEGREES.

Latitude 32 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.24	1	0.23	1	0.22	1	0.21	2	0.19	2	0.17	1	0.16	1	0.15	1	0.14	2	0.12	2	0.10	1	0.09	2	0.07
2	0.48	2	0.46	2	0.44	2	0.42	3	0.39	3	[illegible]	3	[illegible]	[illegible]	[illegible]	3	0.27	3	0.24	3	0.21	3	0.18	3	0.15
3	1.18	4	1.14	4	[illegible]	4	1.06	5	1.01	5	0.56	4	[illegible]	4	0.45	5	[illegible]	5	0.38	5	0.33	5	0.28	4	0.24
4	1.52	6	1.46	6	[illegible]	6	1.34	6	[illegible]	6	1.22	6	1.16	7	1.09	7	1.02	7	0.55	7	0.48	7	0.41	5	0.36
5	2.34	8	2.26	8	2.18	8	2.10	8	2.02	8	1.54	9	[illegible]	[illegible]	1.36	9	1.27	9	1.18	[illegible]	1.09	10	0.59	8	0.51
6	3.28	10	3.18	10	[illegible]	10	[illegible]	10	[illegible]	11	2.37	11	2.26	11	2.15	12	[illegible]	12	1.51	12	1.39	14	1.25	10	1.15
7	4.38	12	4.26	12	4.14	12	4.02	12	[illegible]	[illegible]	3.37	14	[illegible]	14	[illegible]	14	2.55	14	2.41	15	2.26	17	2.09	14	1.55
W E	6.00	13	5.47	13	5.34	13	5.21	13	[illegible]	13	[illegible]	15	4.40	15	4.25	15	4.10	16	3.54	16	3.38	19	3.19	15	3.04
1																					5.10	17	4.53	14	4.39
2																					6.43	19	6.30	11	6.19

16 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.4403381	9.9828416	9.4574964	10.5425036	10.0171584	10.5596619	60
1	9.4407784	9.9828054	9.4579730	10.5420270	10.0171946	10.5592216	59
2	9.4412182	9.9827691	9.4584491	10.5415509	10.0172309	10.5587818	58
3	9.4416576	9.9827328	9.4589248	10.5410752	10.0172672	10.5583424	57
4	9.4420965	9.9826964	9.4594001	10.5405999	10.0173036	10.5579035	56
5	9.4425349	9.9826600	9.4598749	10.5401251	10.0173400	10.5574651	55
6	9.4429728	9.9826236	9.4503492	10.5396508	10.0173764	10.5570272	54
7	9.4434103	9.9825871	9.4608232	10.5391768	10.0174129	10.5565897	53
8	9.4438472	9.9825506	9.4612967	10.5387033	10.0174494	10.5561528	52
9	9.4442837	9.9825140	9.4617697	10.5382303	10.0174860	10.5557163	51
10	9.4447197	9.9824774	9.4622423	10.5377577	10.0175226	10.5552803	50
11	9.4451553	9.9824408	9.4627145	10.5372855	10.0175592	10.5548447	49
12	9.4455904	9.9824041	9.4631863	10.5368137	10.0175959	10.5544096	48
13	9.4460250	9.9823674	9.4636576	10.5363424	10.0176326	10.5539750	47
14	9.4464591	9.9823306	9.4641285	10.5358715	10.0176694	10.5535409	46
15	9.4468927	9.9822938	9.4645990	10.5354010	10.0177062	10.5531073	45
16	9.4473259	9.9822569	9.4650690	10.5349310	10.0177431	10.5526741	44
17	9.4477586	9.9822201	9.4655386	10.5344614	10.0177799	10.5522414	43
18	9.4481909	9.9821831	9.4660078	10.5339922	10.0178169	10.5518091	42
19	9.4486227	9.9821462	9.4664765	10.5335235	10.0178538	10.5513773	41
20	9.4490540	9.9821092	9.4669448	10.5330552	10.0178908	10.5509460	40
21	9.4494849	9.9820721	9.4674127	10.5325873	10.0179279	10.5505151	39
22	9.4499153	9.9820351	9.4678802	10.5321198	10.0179649	10.5500847	38
23	9.4503452	9.9819979	9.4683473	10.5316527	10.0180021	10.5496548	37
24	9.4507747	9.9819608	9.4688139	10.5311861	10.0180392	10.5492253	36
25	9.4512037	9.9819236	9.4692801	10.5307199	10.0180764	10.5487963	35
26	9.4516322	9.9818863	9.4697459	10.5302541	10.0181137	10.5483678	34
27	9.4520603	9.9818490	9.4702112	10.5297888	10.0181510	10.5479397	33
28	9.4524879	9.9818117	9.4706762	10.5293238	10.0181883	10.5475121	32
29	9.4529151	9.9817744	9.4711407	10.5288593	10.0182256	10.5470849	31
30	9.4533418	9.9817370	9.4716048	10.5283952	10.0182630	10.5466582	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

73 DEGREES.

Latitude 32 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m
S	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.24	1	0.25	1	0.26	1	0.27	2	0.29	2	0.31	1	0.32	1	0.33	1	0.34	2	0.36	2	0.38	2	0.40	1	0.41
2	0.50	2	0.52	2	0.54	3	0.57	3	1.00	3	1.03	3	1.06	3	1.09	3	1.12	3	1.15	3	1.18	3	1.21	3	1.24
3	1.18	4	1.22	4	1.26	4	1.30	5	1.35	5	1.40	4	1.44	4	1.48	5	1.53	5	1.58	5	2.03	5	2.08	4	2.12
4	1.52	6	1.58	6	2.04	6	2.10	6	2.16	6	2.22	6	2.28	6	2.34	[illegible]	2.41	6	[illegible]	6	2.55	11	3.02	6	3.08
5	2.34	8	2.42	8	2.50	8	2.58	8	3.06	8	3.14	9	3.23	9	3.32	9	3.41	9	3.50	9	3.59	9	4.08	8	4.16
6	3.28	10	3.38	10	3.48	10	3.58	10	4.08	11	4.19														
7	4.38																								

16 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	2840153	9588197	2962135	33759434	10429489	35209365	30
31	2842942	9587370	2965299	33723408	10430388	35174824	29
32	2845731	9586543	2968464	33687453	10431289	35140354	28
33	2848520	9585715	2971630	33651568	10432190	35105954	27
34	2851308	9584886	2974796	33615753	10433092	35071625	26
35	2854096	9584056	2977962	33580008	10433995	35037365	25
36	2856884	9583225	2981129	33544333	10434900	35003175	24
37	2859671	9582394	2984297	33508728	10435805	34969055	23
38	2862458	9581562	2987465	33473191	10436712	34935004	22
39	2865245	9580729	2990634	33437724	10437619	34901023	21
40	2868032	9579895	2993803	33402326	10438528	34867110	20
41	2870819	9579060	2996973	33366997	10439437	34833267	19
42	2873605	9578225	3000144	33331736	10440348	34799492	18
43	2876391	9577389	3003315	33296543	10441259	34765785	17
44	2879177	9576552	3006486	33261419	10442172	34732146	16
45	2881963	9575714	3009658	33226362	10443086	34698576	15
46	2884748	9574875	3012831	33191373	10444001	34665073	14
47	2887533	9574035	3016004	33156452	10444917	34631637	13
48	2890318	9573195	3019178	33121598	10445833	34598269	12
49	2893103	9572354	3022352	33086811	10446751	34564969	11
50	2895887	9571512	3025527	33052091	10447670	34531735	10
51	2898671	9570669	3028703	33017438	10448590	34498568	9
52	2901455	9569825	3031879	32982851	10449511	34465467	8
53	2904239	9568981	3035055	32948330	10450433	34432433	7
54	2907022	9568136	3038232	32913876	10451357	34399465	6
55	2909805	9567290	3041410	32879487	10452281	34366563	5
56	2912588	9566443	3044588	32845164	10453206	34333727	4
57	2915371	9565595	3047767	32810907	10454132	34300956	3
58	2918153	9564747	3050946	32776715	10455060	34268251	2
59	2920935	9563898	3054126	32742588	10455988	34235611	1
60	2923717	9563048	3057307	32708526	10456918	34203036	0
	N. Co-Sine.	N. Sine.	N.Co-Tang	N. Tangent.	N.Co.Secant.	N. Secant.	M

73 DEGREES.

Latitude 33 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.25	1	0.24	1	0.23	1	0.22	2	0.20	2	0.18	1	0.17	1	0.16	1	0.15	2	0.13	2	0.11	2	00.9	1	00.8
2	0.51	2	0.49	3	0.46	3	0.43	3	0.40	3	0.37	2	0.35	3	0.32	3	0.29	3	0.26	3	0.23	4	0.19	2	0.17
3	1.20	4	1.16	4	1.12	4	1.08	4	1.04	5	0.59	4	0.55	4	0.51	5	0.46	5	0.41	5	0.36	5	0.31	4	0.27
4	1.54	6	1.48	6	1.42	6	1.36	6	1.30	6	1.24	6	1.18	6	1.12	6	1.06	6	1.00	7	0.53	7	0.46	5	0.41
5	2.37	8	2.29	8	2.21	8	2.13	8	2.05	8	1.57	8	1.49	8	1.41	9	1.32	9	1.23	9	1.14	10	1.04	7	1.57
6	3.31	10	3.21	10	3.11	10	3.01	10	3.51	10	2.41	11	2.30	11	2.19	11	2.08	11	1.57	12	1.45	13	1.32	10	2.22
7	4.40	11	4.29	12	4.17	12	4.05	12	3.53	12	3.41	13	3.28	13	3.15	14	3.01	14	2.47	14	2.33	16	2.17	13	2.04
W E	6.00	12	5.48	12	5.36	13	5.23	13	5.10	13	4.57	14	4.43	14	4.29	15	4.14	15	3.59	15	3.44	18	3.26	14	3.12
1											6.21	13	6.08	13	5.55	13	5.42	13	5.29	14	5.15	18	4.57	13	4.44
2																					6.43	13	6.30	10	6.20

16 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.4533418	9.9817370	9.4716048	10.5283952	10.0182630	10.5466582	30
31	9.4537681	9.9816995	9.4720685	10.5279315	10.0183005	10.5462319	29
32	9.4541939	9.9816620	9.4725318	10.5274682	10.0183380	10.5458061	28
33	9.4546192	9.9816245	9.4729947	10.5270053	10.0183755	10.5453808	27
34	9.4550441	9.9815870	9.4734571	10.5265428	10.0184130	10.5449559	26
35	9.4554686	9.9815494	9.4739192	10.5260808	10.0184506	10.5445314	25
36	9.4558926	9.9815117	9.4743808	10.5256192	10.0184883	10.5441074	24
37	9.4563161	9.9814740	9.4748421	10.5251579	10.0185260	10.5436839	23
38	9.4567392	9.9814363	9.4753029	10.5246971	10.0185637	10.5432608	22
39	9.4571618	9.9813986	9.4757633	10.5242367	10.0186014	10.5428382	21
40	9.4575840	9.9813608	9.4762233	10.5237767	10.0186392	10.5424160	20
41	9.4580058	9.9813229	9.4766829	10.5233171	10.0186771	10.5419942	19
42	9.4584271	9.9812850	9.4771421	10.5228579	10.0187150	10.5415729	18
43	9.4588480	9.9812471	9.4776009	10.5223991	10.0187529	10.5411520	17
44	9.4592684	9.9812091	9.4780592	10.5219408	10.0187909	10.5407316	16
45	9.4596884	9.9811711	9.4785172	10.5214828	10.0188289	10.5403116	15
46	9.4601079	9.9811331	9.4789748	10.5210252	10.0188669	10.5398921	14
47	9.4605270	9.9810950	9.4794319	10.5205681	10.0189050	10.5394730	13
48	9.4609456	9.9810569	9.4798887	10.5201113	10.0189431	10.5390544	12
49	9.4613638	9.9810187	9.4803451	10.5196549	10.0189813	10.5386362	11
50	9.4617816	9.9809805	9.4808011	10.5191989	10.0190195	10.5382184	10
51	9.4621989	9.9809423	9.4812566	10.5187434	10.0190577	10.5378011	9
52	9.4626158	9.9809040	9.4817118	10.5182882	10.0190960	10.5373842	8
53	9.4630323	9.9808657	9.4821666	10.5178334	10.0191343	10.5369677	7
54	9.4634483	9.9808273	9.4826210	10.5173790	10.0191727	10.5365517	6
55	9.4638639	9.9807889	9.4830750	10.5169250	10.0192111	10.5361361	5
56	9.4642790	9.9807505	9.4835286	10.5164714	10.0192495	10.5357210	4
57	9.4646938	9.9807120	9.4839818	10.5160182	10.0192880	10.5353062	3
58	9.4651081	9.9806735	9.4844346	10.5155654	10.0193265	10.5348919	2
59	9.4655219	9.9806349	9.4848870	10.5151130	10.0193651	10.5344781	1
60	9.4659353	9.9805963	9.4853390	10.5146610	10.0194037	10.5340647	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

73 DEGREES.

Latitude 33 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.
S	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.25	1	0.26	1	0.27	1	0.28	1	0.29	2	0.31	1	0.32	1	0.33	2	0.35	[illegible]	[illegible]	2	0.39	1	0.40	1	0.41
2	0.51	2	0.53	3	0.56	3	0.59	3	1.02	3	1.05	2	1.07	3	1.10	3	[illegible]	3	1.16	3	1.19	3	1.22	3	1.25
3	1.20	4	1.24	4	1.28	4	1.32	4	1.36	5	1.41	4	1.45	4	1.49	5	[illegible]	5	[illegible]	5	2.04	5	2.09	4	2.13
4	1.54	6	2.00	6	2.06	6	2.12	6	2.18	6	2.24	6	2.30	7	2.37	7	2.44	7	2.51	7	2.58	7	3.05	5	3.10
5	2.37	7	2.44	8	2.52	8	3.00	8	3.08	8	3.16	8	3.24	9	3.33	9	3.42	9	3.51	9	[illegible]	9	4.09	8	4.17
6	3.31	10	3.41	10	3.51	10	4.01	10	4.11	10	4.21	10	4.31	11	4.42	11	4.53	11	5.04						
7	4.40	12	4.52	12	5.04	12	5.16																		

17 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	2923717	9563048	3057307	32708526	10456918	34203036	60
1	2926499	9562197	3060488	32674529	10457848	34170526	59
2	2929280	9561345	3063669	32640596	10458780	34138080	58
3	2932061	9560492	3066851	32606728	10459712	34105699	57
4	2934842	9559639	3070034	32572924	10460646	34073382	56
5	2937623	9558785	3073218	32539184	10461581	34041130	55
6	2940403	9557930	3076402	32505508	10462516	34008941	54
7	2943183	9557074	3079586	32471895	10463453	33976816	53
8	2945963	9556217	3082771	32438346	10464391	33944754	52
9	2948743	9555360	3085957	32404860	10465330	33912755	51
10	2951522	9554502	3089143	32371438	10466270	33880820	50
11	2954301	9553643	3092330	32338078	10467211	33848948	49
12	2957080	9552783	3095517	32304780	10468153	33817138	48
13	2959859	9551922	3098705	32271546	10469096	33785391	47
14	2962638	9551061	3101893	32238373	10470040	33753707	46
15	2965416	9550199	3105082	32205263	10470986	33722084	45
16	2968194	9549336	3108272	32172215	10471932	33690524	44
17	2970971	9548472	3111462	32139228	10472879	33659026	43
18	2973749	9547607	3114653	32106304	10473828	33627589	42
19	2976525	9546742	311[illegible]	32073440	10474777	33596214	41
20	2979303	9545876	312103[illegible]	32040638	10475728	33564900	40
21	2982079	9545009	3124225	32007897	10476679	33533647	39
22	2984856	9544141	3127422	31975217	10477632	33502455	38
23	2987632	9543272	3130616	31942598	10478586	33471324	37
24	2990408	9542403	3133810	31910039	10479540	33440254	36
25	2993184	9541533	3137005	31877540	10480496	33409244	35
26	2995959	9540662	3140200	31845102	10481453	33378294	34
27	2998734	9539790	3143396	31812724	10482411	33347405	33
28	3001509	9538917	3146593	31780406	10483370	33316575	32
29	3004284	9538043	3149790	31748147	10484330	33285805	31
30	3007058	9537169	3152988	31715948	10485291	33255095	30
	N. Co-Sine	N. Sine.	N. Co-Tang	N. Tangent.	N. Co Secant.	N. Secant.	M

72 DEGREES.

Latitude 34 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
S	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.25	1	0.24	1	0.23	1	0.22	1	0.21	2	0.19	1	0.18	1	0.17	1	0.16	2	0.14	2	0.12	2	0.10	1	00.9
2	0.52	2	0.50	4	0.48	3	0.45	3	0.42	3	0.39	3	0.36	3	0.33	3	0.30	3	0.27	3	0.24	3	0.21	2	0.19
3	1.22	4	1.18	4	1.14	4	1.10	4	1.06	5	1.01	4	0.57	4	0.53	5	0.48	5	0.43	5	0.38	4	0.34	4	0.30
4	1.57	5	1.52	6	1.46	6	1.40	6	1.34	6	1.28	6	1.22	6	1.16	6	1.10	7	1.05	7	0.56	7	0.49	6	0.43
5	2.40	7	2.33	8	2.2[illegible]	8	2.17	8	2.09	8	2.01	8	1.53	9	1.45	8	1.37	9	1.28	9	1.19	10	1.09	7	1.02
6	3.34	9	3.25	10	3.15	10	3.05	10	2.55	10	2.45	11	2.35	11	2.24	11	2.13	11	2.02	11	1.51	12	1.39	10	1.29
7	4.42	11	4.31	11	4.20	11	4.09	12	3.57	12	3.4[illegible]	[illegible]	[illegible]	13	3.19	13	3.06	13	2.53	13	2.40	16	2.24	12	2.12
W	6.0	12	5.48	12	5.36	12	[illegible]	12	5.12	12	5.0[illegible]	14	4.46	14	4.32	14	4.15	14	4.04	15	3.49	16	3.33	14	3.19
1											6.21	13	6.08	13	5.55	13	5.42	13	5.29	13	5.16	15	5.01	12	4.49
2																					6.43	12	6.31	10	6.21

17 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.4659353	9.9805963	9.4853390	10.5146610	10.0194037	10.5340647	60
1	9.4663483	9.9805577	9.4857907	10.5142093	10.0194423	10.5336517	59
2	9.4667609	9.9805190	9.4862419	10.5137581	10.0194810	10.5332391	58
3	9.4671730	9.9804803	9.4866928	10.5133072	10.0195197	10.5328270	57
4	9.4675848	9.9804415	9.4871433	10.5128567	10.0195585	10.5324152	56
5	9.4679960	9.9804027	9.4875933	10.5124067	10.0195973	10.5320040	55
6	9.4684069	9.9803639	9.4880430	10.5119570	10.0196361	10.5315931	54
7	9.4688173	9.9803250	9.4884924	10.5115076	10.0196750	10.5311827	53
8	9.4692273	9.9802860	9.4889413	10.5110587	10.0197140	10.5307727	52
9	9.4696369	9.9802471	9.4893898	10.5106102	10.0197529	10.5303631	51
10	9.4700461	9.9802081	9.4898380	10.5101620	10.0197919	10.5299539	50
11	9.4704548	9.9801690	9.4902858	10.5097142	10.0198310	10.5295452	49
12	9.4708631	9.9801299	9.4907332	10.5092668	10.0198701	10.5291369	48
13	9.4712710	9.9800908	9.4911802	10.5088198	10.0199092	10.5287290	47
14	9.4716785	9.9800516	9.4916269	10.5083731	10.0199484	10.5283215	46
15	9.4720856	9.9800124	9.4920731	10.5079269	10.0199876	10.5279144	45
16	9.4724922	9.9799732	9.4925190	10.5074810	10.0200268	10.5275078	44
17	9.4728985	9.9799339	9.4929646	10.5070354	10.0200661	10.5271015	43
18	9.4733043	9.9798946	9.4934097	10.5065903	10.0201034	10.5266957	42
19	9.4737097	9.9798552	9.4938545	10.5061455	10.0201448	10.5262903	41
20	9.4741146	9.9798158	9.4942988	10.5057012	10.0201842	10.5258854	40
21	9.4745192	9.9797764	9.4947429	10.5052571	10.0202236	10.5254808	39
22	9.4749234	9.9797369	9.4951865	10.5048135	10.0202631	10.5250766	38
23	9.4753271	9.9796973	9.4956298	10.5043702	10.0203027	10.5246729	37
24	9.4757304	9.9796578	9.4960727	10.5039273	10.0203422	10.5242696	36
25	9.4761334	9.9796182	9.4965152	10.5034848	10.0203818	10.5238666	35
26	9.4765359	9.9795785	9.4969574	10.5030426	10.0204215	10.5234641	34
27	9.4769380	9.9795388	9.4973991	10.5026009	10.0204612	10.5230620	33
28	9.4773396	9.9794991	9.4978405	10.5021594	10.0205009	10.5226604	32
29	9.4777409	9.9794593	9.4982816	10.5017184	10.0205407	10.5222591	31
30	9.4781418	9.9794195	9.4987223	10.5012777	10.0205805	10.5218582	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

72 DEGREES.

Latitude 34 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.
S	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.25	1	0.26	1	0.27	1	0.28	2	0.30	2	0.32	1	0.33	1	0.34	1	0.35	2	0.37	2	0.39	2	0.41	1	0.42
2	0.52	2	0.54	3	0.57	3	1.00	3	1.03	3	1.06	2	1.08	3	1.11	3	1.14	3	1.17	3	1.20	3	1.23	3	1.26
3	1.22	4	1.26	4	1.30	4	1.34	4	1.38	5	1.43	4	1.47	4	1.51	4	1.55	5	2.00	5	2.05	5	2.10	4	2.14
4	1.57	5	2.02	6	2.08	6	2.14	6	2.20	6	2.26	6	2.32	6	2.38	6	2.44	7	2.51	7	2.58	7	3.05	5	3.10
5	2.40	7	2.47	7	2.54	8	3.02	8	3.10	8	3.18	8	3.26	8	3.34	9	3.43	9	3.52	9	4.01	9	4.10	8	4.18
6	3.34	9	3.43	9	3.52	10	4.02	10	4.12	10	4.22	10	4.32	10	4.42	10	4.52								
7	4.42	11	4.53	11	5.04	11	5.15																		

17 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	3007058	9537169	3152988	31715948	10485291	33255095	30
31	3009832	9536294	3156186	31683808	10486253	33224444	29
32	3012606	9535418	3159385	31651728	10487217	33193853	28
33	3015380	9534541	3162585	31619706	10488181	33163320	27
34	3018153	9533664	3165785	31587744	10489146	33132847	26
35	3020926	9532786	3168986	31555840	10490113	33102432	25
36	3023699	9531907	3172187	31523994	10491080	33072076	24
37	3026471	9531027	3175389	31492207	10492049	33041778	23
38	3029244	9530146	3178591	31460478	10493019	33011539	22
39	3032016	9529264	3181794	31428807	10493989	32981357	21
40	3034788	9528382	3184998	31397194	10494961	32951234	20
41	3037559	9527499	3188202	31365639	10495934	32921168	19
42	3040331	9526615	3191407	31334141	10496908	32891160	18
43	3043102	9525730	3194613	31302701	10497883	32861209	17
44	3045872	9524844	3197819	31271317	10498859	32831316	16
45	3048643	9523958	3201025	31239991	10499836	32801479	15
46	3051413	9523071	3204232	31208722	10500815	32771700	14
47	3054183	9522183	3207440	31177509	10501794	32741977	13
48	3056953	9521294	3210649	31146353	10502774	32712311	12
49	3059723	9520404	3213858	31115254	10503756	32682702	11
50	3062492	9519514	3217067	31084210	10504738	32653149	10
51	3065261	9518623	3220277	31053223	10505722	32623652	9
52	3068029	9517731	3223488	31022291	10506706	32594211	8
53	3070798	9516838	3226700	30991416	10507692	32564825	7
54	3073566	9515944	3229912	30960596	10508679	32535496	6
55	3076334	9515049	3233125	30929831	10509667	32506222	5
56	3079102	9514154	3236338	30899122	10510656	32477003	4
57	3081869	9513258	3239552	30868468	10511646	32447840	3
58	3084636	9512361	3242766	30837869	10512637	32418732	2
59	3087403	9511463	3245981	30807325	10513629	32389678	1
60	3090170	9510565	3249197	30776835	10514622	32360680	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

72 DEGREES.

Latitude 35 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.26	1	0.25	1	0.24	1	0.23	2	0.21	2	0.19	1	[illegible]	1	0.17	1	0.16	1	0.15	2	0.13	2	0.11	1	0.10
2	0.53	2	0.51	2	0.49	3	0.46	3	0.43	3	0.40	2	0.38	3	0.35	3	0.32	3	0.29	3	0.26	3	0.23	3	0.20
3	1.24	4	1.20	4	1.16	4	1.12	4	1.08	5	1.03	4	0.59	4	0.55	4	0.51	5	0.46	5	0.41	5	0.36	4	0.32
4	1.59	5	1.54	5	1.49	6	1.43	6	1.37	6	1.31	6	1.25	6	1.19	6	1.13	7	1.06	7	0.59	6	0.53	6	0.47
5	2.43	7	2.36	7	2.29	8	2.21	8	2.13	8	2.05	8	1.57	8	1.49	8	1.41	9	1.32	9	1.23	9	1.14	7	1.07
6	3.37	9	3.28	9	3.19	9	3.10	10	3.00	10	2.50	10	2.40	10	2.30	11	2.19	11	2.08	11	1.57	12	1.45	9	1.36
7	4.43	11	4.32	11	4.21	11	4.10	11	3.59	11	3.48	12	3.36	12	3.24	12	3.12	13	2.59	13	2.46	15	2.31	11	2.20
W E	6.00	11	5.49	11	5.38	12	5.26	12	5.14	12	5.02	13	4.49	13	4.36	13	4.23	14	4.09	14	3.55	16	3.39	13	3.26
1											6.21	12	6.09	12	5.57	12	5.45	13	5.32	13	5.19	15	5.04	11	4.53
2																					6.44	13	6.31	9	6.22

17 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.4781418	9.9794195	9.4987223	10.5012777	10.0205805	10.5218582	30
31	9.4785423	9.9793796	9.4991626	10.5008374	10.0206204	10.5214577	29
32	9.4789423	9.9793398	9.4996026	10.5003974	10.0206602	10.5210577	28
33	9.4793420	9.9792998	9.5000422	10.4999578	10.0207002	10.5206580	27
34	9.4797412	9.9792599	9.5004814	10.4995186	10.0207402	10.5202588	26
35	9.4801401	9.9792198	9.5009203	10.4990797	10.0207802	10.5198599	25
36	9.4805385	9.9791798	9.5013588	10.4986412	10.0208202	10.5194615	24
37	9.4809366	9.9791397	9.5017969	10.4982031	10.0208603	10.5190634	23
38	9.4813342	9.9790996	9.5022347	10.4977653	10.0209004	10.5186658	22
39	9.4817315	9.9790594	9.5026721	10.4973279	10.0209406	10.5182685	21
40	9.4821283	9.9790192	9.5031092	10.4968908	10.0209808	10.5178717	20
41	9.4825248	9.9789789	9.5035459	10.4964541	10.0210211	10.5174752	19
42	9.4829208	9.9789386	9.5039822	10.4960178	10.0210614	10.5170792	18
43	9.4833165	9.9788983	9.5044182	10.4955818	10.0211017	10.5166835	17
44	9.4837117	9.9788579	9.5048538	10.4951462	10.0211421	10.5162883	16
45	9.4841066	9.9788175	9.5052891	10.4947109	10.0211825	10.5158934	15
46	9.4845010	9.9787770	9.5057240	10.4942760	10.0212230	10.5154990	14
47	9.4848951	9.9787365	9.5061586	10.4938414	10.0212635	10.5151049	13
48	9.4852888	9.9786960	9.5065928	10.4934072	10.0213040	10.5147112	12
49	9.4856820	9.9786554	9.5070267	10.4929733	10.0213446	10.5143180	11
50	9.4860749	9.9786148	9.5074602	10.4925398	10.0213852	10.5139251	10
51	9.4864674	9.9785741	9.5078933	10.4921067	10.0214259	10.5135326	9
52	9.4868595	9.9785334	9.5083261	10.4916739	10.0214666	10.5131405	8
53	9.4872512	9.9784927	9.5087586	10.4912414	10.0215073	10.5127488	7
54	9.4876426	9.9784519	9.5091907	10.4908093	10.0215481	10.5123574	6
55	9.4880335	9.9784111	9.5096224	10.4903776	10.0215889	10.5119665	5
56	9.4884240	9.9783702	9.5100539	10.4899461	10.0216298	10.5115760	4
57	9.4888142	9.9783293	9.5104849	10.4895151	10.0216707	10.5111858	3
58	9.4892040	9.9782883	9.5109156	10.4890844	10.0217117	10.5107960	2
59	9.4895934	9.9782474	9.5113460	10.4886540	10.0217526	10.5104066	1
60	9.4899824	9.9782063	9.5117760	10.4882240	10.0217937	10.5100176	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

72 DEGREES.

Latitude 35 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.
S	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.26	1	0.27	1	0.28	1	0.29	2	0.31	2	0.33	1	0.34	1	0.35	1	0.36	2	0.38	2	0.40	1	0.41	1	0.42
2	0.53	2	0.55	3	0.58	3	1.01	3	1.04	3	1.07	2	1.09	3	1.12	3	1.15	3	1.18	3	1.21	3	1.24	3	1.27
3	1.24	4	1.28	4	1.32	4	1.36	4	1.40	5	1.45	4	1.49	4	1.53	4	1.57	5	2.02	5	2.07	5	2.12	3	2.15
4	1.59	5	2.04	6	2.10	6	2.16	6	2.22	6	2.28	6	2.34	6	2.40	6	2.46	6	2.52	7	2.59	7	3.06	5	3.11
5	2.43	7	2.50	7	2.57	7	3.04	8	3.12	8	3.20	8	3.28	8	3.36	8	3.44	9	3.53	9	4.02	9	4.11	7	4.18
6	3.37	9	3.46	9	3.55	9	4.04	10	4.14	10	4.24	10	4.34	10	4.44	10	4.54								
7	4.43	11	4.54	11	5.05	11	5.16																		

18 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	3090170	9510565	3249197	30776835	10514622	32360680	60
1	3092936	9509666	3252413	30746400	10515617	32331736	59
2	3095702	9508756	3255630	30716020	10516612	32302846	58
3	3098468	9507865	3258848	30685693	10517608	32274011	57
4	3101234	9506963	3262066	30655421	10518606	32245230	56
5	3103999	9506060	3265285	30625203	10519605	32216503	55
6	3106764	9505157	3268504	30595038	10520604	32187830	54
7	3109529	9504253	3271724	30564928	10521605	32159210	53
8	3112294	9503348	3274944	30534870	10522607	32130644	52
9	3115058	9502442	3278165	30504866	10523610	32102132	51
10	3117822	9501536	3281387	30474915	10524614	32073673	50
11	3120586	9500629	3284610	30445018	10525619	32045266	49
12	3123349	9499721	3287833	30415173	10526625	32016913	48
13	3126112	9498812	3291056	30385381	10527633	31988613	47
14	3128875	9497902	3294280	30355641	10528641	31960365	46
15	3131638	9496991	3297505	30325954	10529651	31932170	45
16	3134400	9496080	3300731	30296320	10530661	31904028	44
17	3137163	9495168	3303957	30266737	10531673	31875937	43
18	3139925	9494255	3307184	30237207	10532686	31847899	42
19	3142686	9493341	3310411	30207728	10533699	31819913	41
20	3145448	9492426	3313639	30178301	10534714	31791978	40
21	3148209	9491511	3316868	30148926	10535730	31764095	39
22	3150969	9490595	3320097	30119602	10536747	31736264	38
23	3153730	9489678	3323327	30090330	10537765	31708484	37
24	3156490	9488760	3326557	30061109	10538785	31680756	36
25	3159250	9487841	3329788	30031939	10539805	31653078	35
26	3162010	9486922	3333020	30002820	10540826	31625452	34
27	3164770	9486002	3336252	39973751	10541849	31597876	33
28	3167529	9485081	3339485	39944734	10542873	31570351	32
29	3170288	9484159	3342719	39915766	10543897	31542877	31
30	3173047	9483236	3345953	39886850	10544923	31515453	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

71 DEGREES.

Latitude 36 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.27	1	0.26	1	0.25	1	0.24	2	0.22	2	0.20	1	0.19	1	0.18	1	0.17	2	0.15	2	0.13	1	0.12	1	0.11
2	0.55	2	0.53	2	0.51	3	0.48	3	0.45	3	0.42	2	0.40	3	0.37	3	0.34	3	0.31	3	0.28	4	0.24	2	0.22
3	1.26	4	1.22	4	1.18	4	1.14	4	1.10	5	1.05	4	1.01	4	0.57	4	0.53	4	0.49	5	0.44	5	0.39	4	0.35
4	2.02	5	1.57	5	1.52	6	1.46	6	1.40	6	1.34	6	1.28	6	1.22	6	1.16	6	1.10	7	1.03	7	0.56	5	0.51
5	2.45	7	2.38	7	2.31	7	2.24	8	2.16	8	2.08	8	2.00	8	1.52	8	1.44	8	1.36	8	1.28	9	1.19	7	1.12
6	3.39	9	3.30	9	3.21	9	3.12	9	3.03	10	2.53	10	2.43	10	2.33	10	2.23	10	2.13	10	2.03	11	1.51	9	1.42
7	4.45	10	4.35	10	4.25	11	4.14	11	4.03	11	3.52	12	3.40	12	3.28	12	3.16	12	3.04	12	2.52	14	2.38	11	2.27
W E	6.00	11	5.49	11	5.38	11	5.27	11	5.16	12	5.04	12	4.52	13	4.39	13	4.26	13	4.13	13	4.00	15	3.45	12	3.33
1											6.22	12	6.10	12	5.58	12	5.46	12	5.34	12	5.22	14	5.08	11	4.57
2																					6.44	11	6.33	9	6.24

18 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.4899824	9.9782063	9.5117760	10.4882240	10.0217937	10.5100176	60
1	9.4903710	9.9781653	9.5122057	10.4877943	10.0218347	10.5096290	59
2	9.4907592	9.9781241	9.5126351	10.4873649	10.0218759	10.5092408	58
3	9.4911471	9.9780830	9.5130641	10.4869359	10.0219170	10.5088529	57
4	9.4915345	9.9780418	9.5134927	10.4865073	10.0219582	10.5084655	56
5	9.4919216	9.9780006	9.5139210	10.4860790	10.0219994	10.5080784	55
6	9.4923083	9.9779593	9.5143490	10.4856510	10.0220407	10.5076917	54
7	9.4926946	9.9779180	9.5147766	10.4852234	10.0220820	10.5073054	53
8	9.4930806	9.9778766	9.5152039	10.4847961	10.0221233	10.5069194	52
9	9.4934661	9.9778353	9.5156309	10.4843691	10.0221647	10.5065339	51
10	9.4938513	9.9777938	9.5160575	10.4839425	10.0222062	10.5061487	50
11	9.4942361	9.9777523	9.5164838	10.4835162	10.0222477	10.5057639	49
12	9.4946205	9.9777108	9.5169097	10.4830903	10.0222892	10.5053795	48
13	9.4950046	9.9776693	9.5173353	10.4826647	10.0223307	10.5049954	47
14	9.4953883	9.9776277	9.5177606	10.4822394	10.0223723	10.5046117	46
15	9.4957716	9.9775860	9.5181855	10.4818145	10.0224140	10.5042284	45
16	9.4961545	9.9775444	9.5186101	10.4813899	10.0224556	10.5038455	44
17	9.4965370	9.9775026	9.5190344	10.4809656	10.0224974	10.5034630	43
18	9.4969192	9.9774609	9.5194583	10.4805417	10.0225391	10.5030808	42
19	9.4973010	9.9774191	9.5198819	10.4801181	10.0225809	10.5026990	41
20	9.4976824	9.9773772	9.5203052	10.4796948	10.0226228	10.5023176	40
21	9.4980635	9.9773354	9.5207282	10.4792718	10.0226646	10.5019365	39
22	9.4984442	9.9772934	9.5211508	10.4788492	10.0227066	10.5015558	38
23	9.4988245	9.9772515	9.5215730	10.4784270	10.0227485	10.5011755	37
24	9.4992045	9.9772095	9.5219950	10.4780050	10.0227905	10.5007955	36
25	9.4995840	9.9771674	9.5224166	10.4775834	10.0228326	10.5004160	35
26	9.4999633	9.9771253	9.5228379	10.4771621	10.0228747	10.5000367	34
27	9.5003421	9.9770832	9.5232589	10.4767411	10.0229168	10.4996579	33
28	9.5007206	9.9770410	9.5236795	10.4763205	10.0229590	10.4992794	32
29	9.5010987	9.9769988	9.5240999	10.4759001	10.0230012	10.4989013	31
30	9.5014764	9.9769566	9.5245199	10.4754801	10.0230434	10.4985236	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

71 DEGREES.

Latitude 36 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.27	1	0.28	1	0.29	1	0.30	1	0.31	2	0.33	1	0.34	1	0.35	1	0.36	2	0.38	2	0.40	1	0.41	1	0.32
2	0.55	2	0.57	2	0.59	3	1.02	3	1.05	3	1.08	2	1.10	3	1.13	3	1.16	3	1.19	3	1.22	3	1.25	2	1.27
3	1.26	4	1.30	4	1.34	4	1.38	4	1.42	4	1.46	4	1.50	4	1.54	4	1.58	5	2.03	5	2.08	5	2.13	3	2.16
4	2.02	5	2.07	5	2.12	6	2.18	6	2.24	6	2.30	6	2.36	6	2.42	6	2.48	6	2.54	7	3.01	6	3.07	5	3.12
5	2.45	7	2.52	7	2.59	7	3.06	8	3.14	8	3.22	8	3.30	8	3.38	8	3.46	8	3.54	9	4.03	9	4.12	6	4.18
6	3.39	9	3.48	9	3.57	9	4. 6	9	4.15	10	4.25	9	4.34	9	4.43										
7	4.45	9	4.54	10	5.04																				
W E																									

18 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	V. Co-Tang.	N. Secant.	N.Co-Secant.	
30	3173047	9483236	3345953	29886850	10544923	31515453	30
31	3175805	9482313	3349188	29857983	10545950	31488079	29
32	3178563	9481389	3352424	29829166	10546978	31460756	28
33	3181321	9480464	3355660	29800400	10548007	31433483	27
34	3184079	9479538	3358897	29771683	10549037	31406259	26
35	3186836	9478611	3362134	29743016	10550068	31379086	25
36	3189593	9477684	3365372	29714399	10551101	31351962	24
37	3192350	9476756	3368611	29685831	10552134	31324887	23
38	3195106	9475827	3371850	29657312	10553169	31297862	22
39	3197863	9474897	3375090	29628842	10554204	31270886	21
40	3200619	9473966	3378330	29600422	10555241	31243959	20
41	3203374	9473035	3381571	29572050	10556279	31217081	19
42	3206130	9472103	3384813	29543727	10557318	31190252	18
43	3208885	9471170	3388056	29515453	10558358	31163472	17
44	3211640	9470236	3391299	29487227	10559399	31136740	16
45	3214395	9469301	3394543	29459050	10560441	31110057	15
46	3217149	9468366	3397787	29430921	10561485	31083422	14
47	3219903	9467430	3401032	29402840	10562529	31056835	13
48	3222657	9466493	3404278	29374807	10563575	31030296	12
49	3225410	9465555	3407524	29346822	10564621	31003805	11
50	3228164	9464616	3410771	29318885	10565669	30977363	10
51	3230917	9363676	3414019	29290995	10566718	30950967	9
52	3233670	9462736	3417267	29263152	10567768	30924620	8
53	3236422	9461795	3420516	29235358	10568819	30898319	7
54	3239174	9460853	3423765	29207610	10569871	30872066	6
55	3241926	9459910	3427015	29179909	10570924	30845860	5
56	3244678	9458967	3430266	29152256	10571978	30819702	4
57	3247429	9458023	3433518	29124649	10573034	30793590	3
58	3250180	9457078	3436770	29097089	10574090	30767525	2
59	3252931	9456132	3440023	29069576	10575148	30741507	1
60	3255682	9455185	3443276	29042109	10576207	30715535	0
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N.Tangent.	N.Co-Secant.	N. Secant.	M

71 DEGREES.

Latitude 37 Deg. 00 Min: North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.27	1	0.26	1	0.25	1	0.24	1	0.23	2	0.21	1	0.20	1	0.19	1	0.18	2	0.16	2	0.14	1	0.13	1	0.12
2	0.56	2	0.54	2	0.52	3	0.49	3	0.46	3	0.43	2	0.41	3	0.38	3	0.35	3	0.32	3	0.29	3	0.26	2	0.24
3	1.28	4	1.24	4	1.20	4	1.16	4	1.12	4	1.08	4	1.04	4	1.00	4	0.56	4	0.52	5	0.47	6	0.41	3	0.38
4	2.04	5	1.59	5	1.54	6	1.48	6	1.42	6	1.36	5	1.31	6	1.25	6	1.19	6	1.13	6	1.07	7	1.00	5	0.55
5	2.48	7	2.41	7	2.34	7	2.27	7	2.20	8	2.12	7	2.05	8	1.57	8	1.49	8	1.41	8	1.33	9	1.24	7	1.17
6	3.42	9	3.33	9	3.24	9	3.15	9	3.06	9	2.57	9	2.48	10	2.38	10	2.28	10	2.18	10	2.08	11	1.57	9	1.48
7	4.47	10	4.37	10	4.27	10	4.17	10	4.07	11	3.56	11	3.45	11	3.34	12	3.22	12	[illegible].10	12	2.58	13	2.45	11	2.34
W E	6.00	10	5.50	11	5.39	11	5.28	11	5.17	11	5.06	12	4.54	12	4.42	12	4.30	[illegible]	4.18	13	4.05	15	3.50	11	3.39
1											6.22	11	6.11	11	6.00	12	5.48	12	5.36	12	[illegible].24	13	5.11	11	5.00
2																					5.44	11	6.33	[illegible]	6.25
3																									

18 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.5014764	9.9769566	9.5245199	10.4754801	10.0230434	10.4985236	30
31	9.5018538	9.9769143	9.5249395	10.4750605	10.0230857	10.4981462	29
32	9.5022308	9.9768720	9.5253589	10.4746411	10.0231280	10.4977692	28
33	9.5026075	9.9768296	9.5257779	10.4742221	10.0231704	10.4973925	27
34	9.5029838	9.9767872	9.5261966	10.4738034	10.0232128	10.4970162	26
35	9.5033597	9.9767447	9.5266150	10.4733850	10.0232553	10.4966403	25
36	9.5037353	9.9767022	9.5270331	10.4729669	10.0232978	10.4962647	24
37	9.5041105	9.9766597	9.5274508	10.4725492	10.0233403	10.4958895	23
38	9.5044853	9.9766171	9.5278682	10.4721318	10.0233829	10.4955147	22
39	9.5048598	9.9765745	9.5282853	10.4717147	10.0234255	10.4951402	21
40	9.5052339	9.9765318	9.5287021	10.4712979	10.0234682	10.4947661	20
41	9.5056077	9.9764891	9.5291186	10.4708814	10.0235109	10.4943923	19
42	9.5059811	9.9764464	9.5295347	10.4704653	10.0235536	10.4940189	18
43	9.5063542	9.9764036	9.5299505	10.4700495	10.0235964	10.4936458	17
44	9.5067268	9.9763608	9.5303661	10.4696339	10.0236392	10.4932731	16
45	9.5070992	9.9763179	9.5307813	10.4692187	10.0236821	10.4929008	15
46	9.5074712	9.9762750	9.5311961	10.4688039	10.0237250	10.4925288	14
47	9.5078428	9.9762321	9.5316107	10.4683893	10.0237679	10.4921572	13
48	9.5082141	9.9761891	9.5320250	10.4679750	10.0238109	10.4917859	12
49	9.5085850	9.9761461	9.5324389	10.4675611	10.0238539	10.4914150	11
50	9.5089556	9.9761030	9.5328526	10.4671474	10.0238970	10.4910444	10
51	9.5093258	9.9760599	9.5332659	10.4667341	10.0239401	10.4906742	9
52	9.5096956	9.9760167	9.5336789	10.4663211	10.0239833	10.4903044	8
53	9.5100651	9.9759736	9.5340916	10.4659084	10.0240264	10.4899349	7
54	9.5104343	9.9759303	9.5345040	10.4654960	10.0240697	10.4895657	6
55	9.5108031	9.9758870	9.5349161	10.4650839	10.0241130	10.4891969	5
56	9.5111716	9.9758437	9.5353278	10.4646722	10.0241563	10.4888284	4
57	9.5115397	9.9758004	9.5357393	10.4642607	10.0241996	10.4884603	3
58	9.5119074	9.9757570	9.5361505	10.4638495	10.0242430	10.4880926	2
59	9.5122749	9.9757135	9.5365613	10.4634387	10.0242865	10.4877251	1
60	9.5126419	9.9756701	9.5369719	10.4630281	10.0243299	10.4873581	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

71 DEGREES.

Latitude 37 Deg. 00 Min. South Declination.

	0	d.	2	d	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.27	1	0.28	1	0.29	1	0.30	2	0.32	2	0.34	1	0.35	1	0.36	1	0.37	2	0.39	2	0.41	1	0.42	1	0.43
2	0.56	2	0.58	2	1.00	3	1.03	3	1.06	3	1.09	2	1.11	3	1.14	3	1.17	3	1.20	3	1.23	3	1.26	1	1.27
3	1.28	3	1.31	4	1.35	4	1.39	4	1.43	4	1.47	4	1.51	4	1.55	4	1.59	5	2.04	5	2.09	5	2.14	3	2.17
4	2.04	7	2.11	5	2.16	5	2.21	5	2.26	6	2.32	5	2.37	6	2.43	6	2.49	6	2.55	6	3.01	7	3.08	5	3.13
5	2.48	9	2.57	6	3.03	7	3.10	7	3.17	7	3.24	7	3.31	8	3.39	8	3.47	8	3.55	8	4.03	9	4.12	7	4.19
6	3.42	11	3.53	8	4.01	8	4. 9	8	4.17	9	4.26														
7	4.47	13	5.00	9	5.09	9	5.18																		
W E																									

19 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	3255682	9455185	3443276	29042109	10576207	30715535	60
1	3258432	9454238	3446530	29014688	10577267	30689610	59
2	3261182	9453290	3449785	28987314	10578328	30663731	58
3	3263931	9452341	3453040	28959986	10579390	30637898	57
4	3266681	9451391	3456296	28932704	10580453	30612111	56
5	3269430	9450440	3459553	28905467	10581517	30586370	55
6	3272179	9449489	3462810	28878277	10582583	30560675	54
7	3274928	9448537	3466068	28851132	10583649	30535026	53
8	3277676	9447584	3469327	28824033	10584717	30509423	52
9	3280424	9446630	3472586	28796979	10585786	30483864	51
10	3283172	9445675	3475846	28769970	10586855	30458352	50
11	3285919	9444720	3479107	28743007	10587926	30432884	49
12	3288666	9443764	3482368	28716088	10588999	30407462	48
13	3291413	9442807	3485630	28689215	10590072	30382084	47
14	3294160	9441849	3488893	28662386	10591146	30356752	46
15	3296906	9440890	3492156	28635602	10592221	30331464	45
16	3299652	9439931	3495420	28608863	10593298	30306221	44
17	3302398	9438971	3498685	28582168	10594376	30281023	43
18	3305144	9438010	3501950	28555517	10595454	30255868	42
19	3307889	9437048	3505216	28528911	10596534	30230759	41
20	3310634	9436085	3508483	28502349	10597615	30205693	40
21	3313379	9435121	3511750	28475831	10598697	30180672	39
22	3316123	9434157	3515018	28449356	10599781	30155694	38
23	3318867	9433192	3518287	28422926	10600865	30130760	37
24	3321611	9432226	3521556	28396539	10601951	30105870	36
25	3324355	9431260	3524826	28370196	10603037	30081024	35
26	3327098	9430293	3528097	28343896	10604125	30056221	34
27	3329841	9429325	3531368	28317639	10605214	30031462	33
28	3332584	9428356	3534640	28291426	10606304	30006746	32
29	3335327	9427386	3537913	28265256	10607395	29982073	31
30	3338069	9426415	3541186	28239129	10608487	29957443	30
	N. Co-Sine.	N. Sine.	N.Co-Tang	N. Tangent.	N.Co Secant.	N. Secant.	M

70 DEGREES.

Latitude 38 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.28	1	0.27	1	0.26	1	0.25	2	0.23	2	0.21	1	0.20	1	0.19	1	0.18	1	0.17	2	0.15	2	0.13	1	0.12
2	0.57	2	0.55	2	0.53	2	0.51	3	0.48	3	0.45	2	0.43	3	0.40	3	0.37	3	0.34	3	0.31	3	0.28	2	0.26
3	1.29	3	1.26	4	1.22	4	1.18	4	1.14	4	1.10	4	1.06	4	1.02	4	0.58	4	0.54	5	0.49	5	0.44	3	0.41
4	2.06	5	2.11	5	2.16	5	2.21	6	2.27	6	1.39	5	1.34	6	1.29	6	1.22	6	1.16	6	1.10	6	1.04	5	0.59
5	2.51	7	2.44	7	2.37	7	2.30	7	2.23	8	2.15	7	2.08	7	2.01	8	1.53	8	1.45	8	1.37	8	1.29	7	1.12
6	3.41	8	3.33	8	3.25	8	3.17	8	3.09	8	3.01	9	2.52	9	2.43	10	2.33	10	2.23	10	2.13	10	2.03	9	1.54
7	4.48	9	4.39	9	4.30	9	4.21	10	4.11	10	4.01	11	4.50	11	4.39	12	4.27	12	4.15	12	3.03	13	2.50	10	2.40
WE	6.00	10	5.50	10	5.40	10	5.30	11	5.19	11	5.08	11	4.57	12	4.45	12	4.33	12	4.21	12	4.09	14	3.55	10	3.45
1											6.22	11	6.11	11	6.00	11	5.49	11	5.38	12	5.26	12	5.14	10	5.04
2																				11	6.45	11	6.34	8	6.26

19 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.5126419	9.9756701	9.5369719	10.4630281	10.0243299	10.4873581	60
1	9.5130086	9.9756265	9.5373821	10.4626179	10.0243735	10.4869914	59
2	9.5133750	9.9755830	9.5377920	10.4622080	10.0244170	10.4866250	58
3	9.5137410	9.9755394	9.5382017	10.4617983	10.0244606	10.4862590	57
4	9.5141067	9.9754957	9.5386110	10.4613890	10.0245403	10.4858933	56
5	9.5144721	9.9754521	9.5390200	10.4609800	10.0245479	10.4855279	55
6	9.5148371	9.9754083	9.5394287	10.4605713	10.0245917	10.4851629	54
7	9.5152017	9.9753646	9.5398371	10.4601629	10.0246354	10.4847983	53
8	9.5155660	9.9753208	9.5402453	10.4597547	10.0246792	10.4844340	52
9	9.7159300	9.9752769	9.5406531	10.4593469	10.0247231	10.4840700	51
10	9.5162936	9.9752330	9.5410606	10.4589394	10.0247670	10.4837064	50
11	9.5166569	9.9751891	9.5414678	10.4585322	10.0248109	10.4833431	49
12	9.5170198	9.9751451	9.5418747	10.4581253	10.0248549	10.4829802	48
13	9.5173824	9.9751011	9.5422813	10.4577187	10.0248989	10.4826176	47
14	9.5177447	9.9750570	9.5426877	10.4573123	10.0249430	10.4822553	46
15	9.5181066	9.9750129	9.5430937	10.4569063	10.0249871	10.4818934	45
16	9.5184682	9.9749688	9.5434994	10.4565006	10.0250312	10.4815318	44
17	9.5188295	9.9749246	9.5439048	10.4560952	10.0250754	10.4811705	43
18	9.5191904	9.9748804	9.5443100	10.4556900	10.0251196	10.4808096	42
19	9.5195510	9.9748361	9.5447148	10.4552852	10.0251639	10.4804490	41
20	9.5199112	9.9747918	9.5451193	10.4548807	10.0252082	10.4800888	40
21	9.5202711	9.9747475	9.5455236	10.4544764	10.0252525	10.4797289	39
22	9.5206307	9.9747031	9.5459276	10.4540724	10.0252969	10.4793693	38
23	9.5209899	9.9746587	9.5463312	10.4536688	10.0253413	10.4790101	37
24	9.5213488	9.9746142	9.5467346	10.4532654	10.0253858	10.4786512	36
25	9.5217074	9.9745697	9.5471377	10.4528623	10.0254303	10.4782926	35
26	9.5220656	9.9745252	9.5475405	10.4524595	10.0254748	10.4779344	34
27	9.5224235	9.9744806	9.5479430	10.4520570	10.0255194	10.4775765	33
28	9.5227811	9.9744359	9.5483452	10.4516548	10.0255641	10.4772189	32
29	9.5231383	9.9743913	9.5487471	10.4512529	10.0256087	10.4768617	31
30	9.5234953	9.9743466	9.5491487	10.4508513	10.0256534	10.4765047	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

70 DEGREES.

Latitude 38 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.28	1	0.29	1	0.30	1	0.31	1	0.32	2	0.34	1	0.35	1	0.36	1	0.37	2	0.39	2	0.41	1	0.42	2	0.44
2	0.57	2	0.59	2	1.01	2	1.03	2	1.05	3	1.10	2	1.12	3	1.15	3	1.18	3	1.21	3	1.24	3	1.27	2	1.29
3	1.29	4	1.33	4	1.37	4	1.41	4	1.45	4	1.49	4	1.53	4	1.57	4	2.01	4	2.05	5	2.10	5	2.15	3	2.18
4	2.06	5	2.11	5	2.16	6	2.22	6	2.28	6	2.34	5	2.39	6	2.45	6	2.51	6	2.57	6	3.03	6	3.09	5	3.14
5	2.51	7	2.58	7	3.15	7	3.22	7	3.29	7	3.26	7	3.33	7	3.40	8	3.48	8	3.56	8	4.01	9	4.13	6	4.19
6	3.44	8	3.52	9	4.11	9	4.20	9	4.29	9	4.28														
7	4.48																								

19 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	3338069	9426415	3541186	28239129	10608487	29957443	30
31	3340810	9425443	3544460	28213045	10609580	29932856	29
32	3343552	9424471	3547735	28187003	10610675	29908312	28
33	3346293	9423498	3551010	28161004	10611770	29883811	27
34	3349034	9422524	3554286	28135048	10512867	29859352	26
35	3351775	9421550	3557563	28109134	10613965	29835936	25
36	3354516	9420575	3560840	28083263	10615064	29810563	24
37	3357256	9419599	3564118	28057433	10616164	29786231	23
38	3359996	9418622	3567397	28031646	10617265	29761942	22
39	3362735	9417644	3570676	28005901	10618367	29737695	21
40	3365475	9416665	3573956	27980198	10619471	29713490	20
41	3368214	9415685	3577237	27954537	10620575	29689327	19
42	3370953	9414705	3580518	27928917	10621681	29665205	18
43	3373691	9413724	3583800	27903339	10622788	29641125	17
44	3376429	9412742	3587083	27877802	10623896	29617087	16
45	3379167	9411760	3590367	27852307	10625005	29593090	15
46	3381905	9410777	3593651	27826853	10626115	29569135	14
47	3384642	9409793	3596936	27801440	10627227	29545221	13
48	3387379	9408808	3600222	27776069	10628339	29521348	12
49	3390116	9407822	3603508	27750738	10629453	29497516	11
50	3392853	9406835	3606795	27725448	10630568	29473725	10
51	3395589	9405848	3610083	27700199	10631684	29449975	9
52	3398325	9404860	3613371	27674990	10632801	29426265	8
53	3401060	9403871	3616660	27649822	10633919	29402597	7
54	3403795	9402881	3519950	27624695	10635038	29378968	6
55	3406530	9401890	3623240	27599608	10636158	29355380	5
56	3409265	9400899	3626531	27574561	10637280	29331833	4
57	3412000	9399907	3629823	27549554	10638403	29308326	3
58	3414734	9398914	3633115	27524588	10639527	29284858	2
59	3417468	9397920	3636408	27499661	10640652	29261431	1
60	3420202	9396926	3539702	27474774	10641778	29238044	0
	N. Co-Sine.	N. Sine.	N.Co-Tang	N. Tangent.	N.Co Secant.	N. Secant.	M

70 DEGREES.

Latitude 39 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.39	1	0.38	1	0.37	1	0.36	2	0.34	2	0.22	1	0.21	1	0.20	1	0.19	1	0.18	2	0.16	2	0.14	1	0.13
2	0.58	2	0.56	2	0.54	2	0.52	3	0.49	3	0.46	2	0.44	3	0.41	3	0.38	3	0.35	3	0.32	2	0.30	3	0.27
3	1.31	3	1.28	4	1.24	4	1.20	4	1.16	4	1.12	4	1.08	4	1.04	4	1.00	4	0.56	5	0.51	4	0.47	4	0.43
4	2.09	5	2.04	5	1.59	5	1.54	6	1.48	6	1.42	5	1.37	6	1.31	6	1.25	6	1.19	6	1.13	6	1.07	5	1.02
5	2.53	6	2.48	7	2.41	7	2.34	7	2.27	7	2.19	7	2.12	7	2.05	8	1.57	8	1.49	8	1.41	8	1.33	6	1.27
6	3.47	8	3.39	8	3.31	8	3.23	9	3.14	9	3.05	9	2.56	9	2.47	9	2.38	10	2.28	10	2.18	10	2.08	8	2.00
7	4.50	9	4.41	9	4.32	10	4.22	10	4.12	10	4.02	10	3.52	11	3.41	11	3.30	11	3.19	11	3.08	12	2.56	9	2.47
WE	6.00	10	5.50	10	5.40	10	5.30	10	5.20	10	5.10	11	4.59	11	4.48	11	4.37	12	4.25	12	4.13	13	4.00	10	3.50
1											6.22	10	6.12	10	6.02	11	5.51	11	5.40	11	5.29	13	5.16	9	5.07
2																					6.45	10	6.35	8	6.27

19 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.5234953	9.9743466	9.5491487	10.4508513	10.0256534	10.4765047	30
31	9.5238518	9.9743018	9.5495500	10.4504500	10.0256982	10.4761482	29
32	9.5242081	9.9742570	9.5499511	10.4500489	10.0257430	10.4757919	28
33	9.5245640	9.9742122	9.5503519	10.4496481	10.0257878	10.4754360	27
34	9.5249196	9.9741673	9.5507523	10.4492477	10.0258327	10.4750804	26
35	9.5252749	9.9741224	9.5511525	10.4488475	10.0258776	10.4747251	25
36	9.5256298	9.9740774	9.5515524	10.4484476	10.0259226	10.4743702	24
37	9.5259844	9.9740324	9.5519521	10.4480479	10.0259676	10.4740156	23
38	9.5263387	9.9739873	9.5523514	10.4476486	10.0260127	10.4736613	22
39	9.5266927	9.9739422	9.5527504	10.4472496	10.0260578	10.4733073	21
40	9.5270463	9.9738971	9.5531492	10.4468508	10.0261029	10.4729537	20
41	9.5273997	9.9738519	9.5535477	10.4464523	10.0261481	10.4726003	19
42	9.5277526	9.9738067	9.5539459	10.4460541	10.0261933	10.4722474	18
43	9.5281053	9.9737615	9.5543438	10.4456562	10.0262385	10.4718947	17
44	9.5284577	9.9737162	9.5547415	10.4452585	10.0262838	10.4715423	16
45	9.5288097	9.9736709	9.5551388	10.4448612	10.0263291	10.4711903	15
45	9.5291614	9.9736255	9.5555359	10.4444641	10.0263745	10.4708386	14
47	9.5295128	9.9735801	9.5559327	10.4440673	10.0264199	10.4704872	13
48	9.5298638	9.9735346	9.5563292	10.4436708	10.0264654	10.4701362	12
49	9.5302146	9.9734891	9.5567255	10.4432745	10.0265109	10.4697854	11
50	9.5305650	9.9734435	9.5571214	10.4428786	10.0265565	10.4694350	10
51	9.5309151	9.9733980	9.5575171	10.4424829	10.0266020	10.4690849	9
52	9.5312649	9.9733523	9.5579125	10.4420875	10.0266477	10.4687351	8
53	9.5316143	9.9733067	9.5583077	10.4416923	10.0266933	10.4683857	7
54	9.5319635	9.9732610	9.5587025	10.4412975	10.0267390	10.4680365	6
55	9.5323123	9.9732152	9.5590971	10.4409029	10.0267848	10.4676877	5
56	9.5326608	9.9731694	9.5594914	10.4405086	10.0268306	10.4673392	4
57	9.5330090	9.9731236	9.5598854	10.4401146	10.0268764	10.4669910	3
58	9.5333569	9.9730777	9.5602792	10.4397208	10.0269223	10.4666431	2
59	9.5337044	9.9730318	9.5606727	10.4393273	10.0269682	10.4662956	1
60	9.5340517	9.9739858	9.5610659	10.4389341	10.0270142	10.4659483	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

70 DEGREES.

Latitude 39 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.29	1	0.30	1	0.31	1	0.32	1	0.33	2	0.35	1	0.36	1	0.37	1	0.38	1	0.39	2	0.41	1	0.42	2	0.44
2	0.58	2	1.00	2	1.02	3	1.05	3	1.08	3	1.11	2	1.13	3	1.16	3	1.19	3	1.22	3	1.25	2	1.27	3	1.30
3	1.31	4	1.35	4	1.39	4	1.43	4	1.47	4	1.51	4	1.55	4	1.59	4	2.03	4	2.07	4	2.11	5	2.16	3	2.19
4	2.09	5	2.14	5	2.19	5	2.24	5	2.29	6	2.35	5	2.40	6	2.46	6	2.52	6	2.58	6	3.04	6	3.10	5	3.15
5	2.53	6	2.59	7	3.06	7	3.13	7	3.20	7	3.27	7	3.34	7	3.41	8	3.49	8	3.57	8	4.05	8	4.13	7	4.20
6	3.47	8	3.55	8	4.03	8	4.11	9	4.20	9	4.29														
7	4.50																								
WE																									

20 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	3420202	9396926	3639702	27474774	10641778	29238044	60
1	3422935	9395931	3642997	27449927	10642905	29214697	59
2	3425668	9394935	3646292	27425120	10644033	29191389	58
3	3428401	9393938	3649588	27400352	10645163	29168121	57
4	3431133	9392940	3652885	27375623	10946294	29144892	56
5	3433865	9391942	3656182	27350934	10647426	29121703	55
6	3436597	9390943	3659480	27326284	10648559	29098553	54
7	3439329	9389943	3662779	27301674	10649693	29075443	53
8	3442060	9388942	3666079	27277102	10650828	29052372	52
9	3444791	9387940	3669379	27252569	10651964	29029339	51
10	3447522	9386937	3672680	27228075	10653101	29006346	50
11	3450252	9385934	3675982	27203620	10654240	28983391	49
12	3452982	9384930	3679284	27179204	10655380	28960475	48
13	3455712	9383925	3682587	27154826	10656521	28937598	47
14	3458442	9382919	3685891	27130487	10657663	28914760	46
15	3461171	9381913	3689195	27106186	10658807	28891959	45
16	3463900	9380906	3692500	27081923	10659951	28869198	44
17	3466629	9379898	3695806	27057699	10661097	28846474	43
18	3469357	9378889	3699113	27033513	10662243	28823789	42
19	3472085	9377879	3702420	27009364	10663391	28801142	41
20	3474813	9376869	3705728	26985254	10664540	28778532	40
21	3477540	9375858	3709037	26961181	10665690	28755961	39
22	3480267	9374846	3712346	26937147	10666842	28733428	38
23	3482994	9373833	3715656	26913149	10667994	28710932	37
24	3485721	9372819	3718967	26889190	10669148	28688474	36
25	3488447	9371805	3722278	26865267	10670302	28666053	35
26	3491173	9370790	3725590	26841383	10671458	28643670	34
27	3493899	9369774	3728903	26817535	10672615	28621324	33
28	3496624	9368757	3732217	26793725	10673774	28599015	32
29	3499349	9367740	3735532	26769951	10674934	28576744	31
30	3502074	9366722	3738847	26746215	10676094	28554509	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

69 DEGREES.

Latitude 40 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.29	1	0.28	1	0.27	1	0.26	1	0.25	2	0.23	1	0.22	1	0.21	1	0.20	1	0.19	2	0.17	2	0.15	1	0.14
2	1.00	2	0.58	2	0.56	3	0.53	3	0.50	3	0.47	2	0.45	2	0.43	3	0.40	3	0.37	3	0.34	3	0.31	2	0.29
3	1.33	3	1.30	4	1.26	4	1.22	4	1.18	4	1.14	4	1.10	4	1.06	4	1.02	4	0.58	4	0.54	5	0.49	3	0.46
4	2.11	5	2.06	5	2.01	5	1.56	5	1.01	6	1.45	5	1.40	5	1.35	6	1.29	6	1.23	6	1.17	6	1.11	5	1.06
5	2.56	6	2.50	7	2.43	7	2.36	7	2.29	7	2.22	7	2.15	7	2.08	7	2.01	7	1.54	8	1.46	8	1.38	7	1.31
6	3.49	8	3.41	8	3.33	8	3.25	8	3.17	9	3.08	9	2.59	9	2.50	9	2.41	9	2.32	9	2.23	10	2.13	8	2.05
7	4.51	9	4.42	9	4.33	9	4.24	9	4.15	10	4.05	10	3.55	10	3.45	10	2.35	11	2.24	11	3.13	11	3.02	10	2.52
W E	6.00	9	5.51	10	5.41	10	5.31	10	5.21	10	5.11	10	5.01	11	4.50	11	4.39	11	4.28	11	4.17	12	4.05	10	3.55
1											6.22	10	6.12	10	6.02	10	5.52	10	5.42	11	5.31	12	5.19	9	5.10
2																					6.46	10	6.36	8	6.28
3																									

20 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.5340517	9.9729858	9.5610658	10.4389341	10.0270142	10.4659483	60
1	9.5343986	9.9729398	9.5614588	10.4385412	10.0270602	10.4656014	59
2	9.5347452	9.9728938	9.5618515	10.4381485	10.0271062	10.4652548	58
3	9.5350915	9.9728477	9.5622439	10.4377561	10.0271523	10.4649085	57
4	9.5354375	9.9728016	9.5626360	10.4373640	10.0271984	10.4645625	56
5	9.5357832	9.9727554	9.5630278	10.4369722	10.0272446	10.4642168	55
6	9.5361286	9.9727092	9.5634194	10.4365806	10.0272908	10.4638714	54
7	9.5364737	9.9726629	9.5638107	10.4361893	10.0273371	10.4635263	53
8	9.5368184	9.9726166	9.5642018	10.4357982	10.0273834	10.4631816	52
9	9.5371628	9.9725703	9.5645925	10.4354075	10.0274297	10.4628372	51
10	9.5375069	9.9725239	9.5649831	10.4350169	10.0274761	10.4624930	50
11	9.5378508	9.9724775	9.5653733	10.4346267	10.0275225	10.4621492	49
12	9.5381943	9.9724310	9.5657633	10.4342367	10.0275690	10.4618057	48
13	9.5385375	9.9723845	9.5661530	10.4338470	10.0276155	10.4614625	47
14	9.5388804	9.9723380	9.5665424	10.4334576	10.0276620	10.4611196	46
15	9.5392230	9.9722914	9.5669316	10.4330684	10.0277086	10.4607770	45
16	9.5395653	9.9722448	9.5673205	10.4326795	10.0277552	10.4604347	44
17	9.5399073	9.9721981	9.5677091	10.4322909	10.0278019	10.4600927	43
18	9.5402489	9.9721514	9.5680975	10.4319025	10.0278486	10.4597511	42
19	9.5405903	9.9721047	9.5684856	10.4315144	10.0278953	10.4594097	41
20	9.5409314	9.9720579	9.5688735	10.4311265	10.0279421	10.4590686	40
21	9.5412721	9.9720110	9.5692611	10.4307389	10.0279890	10.4587279	39
22	9.5416126	9.9719642	9.5696484	10.4303516	10.0280358	10.4583874	38
23	9.5419527	9.9719172	9.5700355	10.4299645	10.0280828	10.4580473	37
24	9.5422926	9.9718703	9.5704223	10.4295777	10.0281297	10.4577074	36
25	9.5426321	9.9718233	9.5708088	10.4291912	10.0281767	10.4573679	35
26	9.5429713	9.9717762	9.5711951	10.4288049	10.0282238	10.4570287	34
27	9.5433103	9.9717291	9.5715811	10.4284189	10.0282709	10.4566897	33
28	9.5436489	9.9716820	9.5719669	10.4280331	10.0283180	10.4563511	32
29	9.5439873	9.9716348	9.5723524	10.4276476	10.0283652	10.4560127	31
30	9.5443253	9.9715876	9.5727377	10.4272623	10.0284124	10.4556747	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

69 DEGREES.

Latitude 40 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.29	1	0.30	1	0.31	1	0.32	1	0.33	2	0.35	1	0.36	1	0.37	1	0.38	2	0.40	2	0.42	1	0.43	1	0.44
2	1.00	2	1.02	2	1.04	2	1.06	3	1.09	3	1.12	2	1.14	2	1.16	3	1.19	3	1.22	3	1.25	3	1.28	2	1.30
3	1.33	3	1.36	4	1.40	4	1.44	4	1.48	4	1.52	4	1.56	4	2.00	4	2.04	4	2.08	4	2.12	5	2.17	3	2.20
4	2.11	5	2.16	5	2.21	5	2.26	5	2.31	6	2.37	5	2.42	5	2.47	6	2.53	6	2.59	6	3.05	6	3.11	5	3.16
5	2.56	6	3.02	6	3.08	7	3.15	7	3.22	7	3.29	7	3.36	7	7.43	7	7.50	8	7.58	8	4.06	8	4.14	6	4.20
6	3.49	8	3.57	8	4.05	8	4.13	8	4.21	9	4.30	9	4.39	8	4.47	6	4.53								
7	4.51	8	4.59	9	5.08	9	5.17	9	5.26																
W E																									

20 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	3502074	9366722	3738847	26746215	10676094	28554509	30
31	3504799	9365703	3742163	26722516	10677255	28532312	29
32	3507523	9364683	3745479	26698853	10678418	28510152	28
33	3510247	9363662	3748797	26675227	10679582	28488028	27
34	3512970	9362640	3752115	26651638	10680747	28465941	26
35	3515693	9361618	3755434	26628085	10681914	28443891	25
36	3518416	9360595	3758753	26604569	10683081	28421877	24
37	3521139	9359571	3762073	26581089	10684250	28399899	23
38	3523862	9358546	3765394	26557645	10685420	28377959	22
39	3526584	9357521	3768716	26534238	10686591	28356054	21
40	3529306	9356495	3772038	26510867	10687763	28334185	20
41	3532027	9355468	3775361	26487531	10688936	28312353	19
42	3534748	9354440	3778685	26464232	10690110	28290556	18
43	3537469	9353411	3782010	26440969	10691286	28268796	17
44	3540190	9352382	3785335	26417741	10692463	28247071	16
45	3542910	9351352	3788661	26394549	10693641	28225382	15
46	3545630	9350321	3791988	26371392	10694820	28203729	14
47	3548350	9349289	3795316	26348271	10696000	28182111	13
48	3551070	9348256	3798644	26325186	10697182	28160529	12
49	3553789	9347223	3801973	26302136	10698364	28138982	11
50	3556508	9346189	3805303	26279121	10699548	28117471	10
51	3559226	9345154	3808633	26256141	10700733	28095995	9
52	3561944	9344118	3811964	26233196	10701919	28074554	8
53	3564662	9343082	3815296	26210286	10703106	28053148	7
54	3567380	9342045	3818629	26187411	10704295	28031777	6
55	3570097	9341007	3821962	26164571	10705484	28010441	5
56	3572814	9339965	3825296	26141766	10706675	27989140	4
57	3575531	9338928	3828631	26118995	10707867	27967873	3
58	3578248	9337887	3831967	26096259	10709060	27946641	2
59	3580964	9336846	3835303	26073558	10710254	27925444	1
60	3583679	9335804	3838640	26050891	10711450	27904281	0
	N. Co-Sine.	N. Sine.	N.Co-Tang	N. Tangent.	N.Co.Secant.	N. Secant.	M

69 DEGREES.

Latitude 41 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	2	0.24	1	0.23	1	0.22	1	0.21	2	0.19	2	0.17	1	0.16	1	0.15
2	1.01	2	0.59	2	0.57	2	0.55	3	0.52	3	0.49	2	0.47	2	0.45	3	0.42	3	0.39	3	0.36	3	0.33	2	0.31
3	1.35	3	0.32	4	0.28	4	0.24	4	0.20	4	1.16	4	1.12	4	1.08	4	1.04	4	1.00	4	0.56	4	0.52	4	0.48
4	2.13	5	2.08	5	2.03	5	1.58	5	1.53	5	1.48	5	1.43	5	1.38	6	1.32	6	1.26	6	1.20	6	1.14	5	1.09
5	2.58	6	2.52	6	2.46	7	2.39	7	2.32	7	2.25	7	2.18	7	2.11	7	2.04	7	1.57	7	1.50	8	1.42	6	1.36
6	3.51	8	3.43	8	3.35	8	3.27	8	3.19	8	3.11	8	3.03	8	2.55	9	2.46	9	2.37	9	2.28	10	2.18	7	2.11
7	4.53	9	4.44	9	4.35	9	4.26	9	4.17	9	4.03	10	3.58	10	3.46	10	3.38	10	3.28	10	3.18	11	3.07	9	2.58
WE	6.00	9	5.51	9	5.42	9	5.33	10	5.23	10	5.13	10	5.03	10	4.53	10	4.43	11	4.32	11	4.21	12	4.09	9	4.00
1											6.23	10	6.13	10	6.03	10	5.53	10	5.43	10	5.33	11	5.22	9	5.13
2																					6.46	9	6.37	8	6.29
3																									

20 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.5443253	9.9715876	9.5727377	10.4272623	10.0284124	10.4556747	30
31	9.5446630	9.9715404	9.5731227	10.4268773	10.0284596	10.4553370	29
32	9.5450005	9.9714931	9.5735074	10.4264926	10.0285069	10.4549995	28
33	9.5453376	9.9714457	9.5738919	10.4261081	10.0285543	10.4546624	27
34	9.5456745	9.9713984	9.5742761	10.4257239	10.0286016	10.4543255	26
35	9.5460110	9.9713509	9.5746601	10.4253399	10.0286491	10.4539890	25
36	9.5463472	9.9713035	9.5750438	10.4249562	10.0286965	10.4536528	24
37	9.5466832	9.9712560	9.5754272	10.4245728	10.0287440	10.4533168	23
38	9.5470189	9.9712084	9.5758104	10.4241896	10.0287916	10.4529811	22
39	9.5473542	9.9711608	9.5761934	10.4238066	10.0288392	10.4526458	21
40	9.5476893	9.9711132	9.5765761	10.4234239	10.0288868	10.4523107	20
41	9.5480240	9.9710655	9.5769585	10.4230415	10.0289345	10.4519760	19
42	9.5483585	9.9710178	9.5773407	10.4226593	10.0289822	10.4516415	18
43	9.5486927	9.9709701	9.5777226	10.4222774	10.0290299	10.4513073	17
44	9.5490266	9.9709223	9.5781043	10.4218957	10.0290777	10.4509734	16
45	9.5493602	9.9708744	9.5784858	10.4215142	10.0291256	10.4506398	15
46	9.5496935	9.9708265	9.5788669	10.4211331	10.0291735	10.4503065	14
47	9.5500265	9.9707786	9.5792479	10.4207521	10.0292214	10.4499735	13
48	9.5503592	9.9707306	9.5796286	10.4203714	10.0292694	10.4496408	12
49	9.5506916	9.9706826	9.5800090	10.4199910	10.0293174	10.4493084	11
50	9.5510237	9.9706346	9.5803892	10.4196108	10.0293654	10.4489763	10
51	9.5513556	9.9705865	9.5807691	10.4192309	10.0294135	10.4486444	9
52	9.5516871	9.9705383	9.5811488	10.4188512	10.0294617	10.4483129	8
53	9.5520184	9.9704902	9.5815282	10.4184718	10.0295098	10.4479816	7
54	9.5523494	9.9704419	9.5819074	10.4180926	10.0295581	10.4476506	6
55	9.5526801	9.9703937	9.5822864	10.4177136	10.0296063	10.4473199	5
56	9.5530105	9.9703454	9.5826651	10.4173349	10.0296546	10.4469895	4
57	9.5533406	9.9702970	9.5830435	10.4169565	10.0297030	10.4466594	3
58	9.5536704	9.9702486	9.5834217	10.4165783	10.0297514	10.4463296	2
59	9.5539999	9.9702002	9.5837997	10.4162003	10.0297998	10.4460001	1
60	9.5543292	9.9701517	9.5841774	10.4158226	10.0298483	10.4456708	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

69 DEGREES.

Latitude 41 Deg. 00 Min. South Declination.

	0	d.	2	d	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.30	1	0.31	1	0.32	1	0.33	1	0.34	2	0.36	1	0.37	1	0.38	1	0.39	1	0.40	2	0.42	2	0.44	1	0.45
2	1.01	2	1.03	2	1.05	2	1.07	3	1.10	3	1.13	2	1.15	2	1.17	3	1.20	3	1.23	3	1.26	3	1.29	2	1.31
3	1.35	3	1.38	3	1.41	4	1.45	4	1.49	4	1.53	4	1.57	4	2.01	4	2.05	4	2.09	4	2.13	5	2.18	3	2.21
4	2.13	5	2.18	5	2.23	5	2.28	5	3.33	6	2.39	5	2.44	5	2.49	5	2.54	6	3.00	6	3.06	6	3.12	5	3.17
5	2.58	6	3.04	6	3.10	7	3.17	7	3.24	7	3.31	7	3.38	7	3.45	7	3.52	7	3.59	7	4.06	8	4.14	6	4.20
6	3.51	7	3.58	8	4.06	8	4.14	8	4.22	8	4.30														
7	4.53																								
WE																									

21 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	3583679	9335804	3838640	26050891	10711450	27904281	60
1	3586395	9334761	3841978	26028258	10712647	27883153	59
2	3589110	9333717	3845317	26005659	10713844	27862059	58
3	3591825	9332673	3848656	25983095	10715043	27840999	57
4	3594540	9331628	3851996	25960564	10716244	27819973	56
5	3597254	9330582	3855337	25938068	10717445	27798982	55
6	3599968	9329535	3858679	25915606	10718647	27778024	54
7	3602682	9328487	3862021	25893177	10719851	27757100	53
8	3605395	9327439	3865364	25870782	10721056	27736211	52
9	3608108	9326390	3868708	25848421	10722262	27715355	51
10	3610821	9325340	3872053	25826094	10723469	27694532	50
11	3613533	9324289	3875398	25803800	10724678	27673743	49
12	3616246	9323238	3878744	25781539	10725887	27652988	48
13	3618958	9322186	3882091	25759312	10727098	27632266	47
14	3621669	9321133	3885439	25737118	10728310	27611578	46
15	3624380	9320079	3888787	25714957	10729523	27590923	45
16	3627091	9319024	3892136	25692830	10730737	27570301	44
17	3629802	9317968	3895486	25670735	10731953	27549712	43
18	3632512	9316912	3898837	25648674	10733170	27529157	42
19	3635222	9315855	3902189	25626645	10734388	27508634	41
20	3637932	9314797	3905541	25604649	10735607	27488144	40
21	3640641	9313738	3908894	25582686	10736827	27467687	39
22	3643350	9312679	3912248	25560756	10738048	27447263	38
23	3646059	9311619	3915602	25538858	10739271	27426871	37
24	3648768	9310558	3918957	25516992	10740495	27406512	36
25	3651476	9309496	3922313	25495160	10741720	27386186	35
26	3654184	9308433	3925670	25473359	10742946	27365892	34
27	3656892	9307370	3929028	25451591	10744173	27345630	33
28	3659599	9306306	3932386	25429855	10745402	27325400	32
29	3662306	9305241	3935745	25408151	10746631	27305203	31
30	3665013	9304175	3939105	25386479	10747862	27285038	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

68 DEGREES.

Latitude 42 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	2	0.24	1	0.23	1	0.22	1	0.21	1	0.20	2	0.18	1	0.17	1	0.16
2	1.02	2	1.00	2	0.58	2	0.56	3	0.53	3	0.50	2	0.48	2	0.46	3	0.43	3	0.40	3	0.37	3	0.34	2	0.32
3	1.36	3	1.33	3	1.30	4	1.26	4	1.22	4	1.18	4	1.14	4	1.10	4	1.06	4	1.02	4	0.58	4	0.54	3	0.51
4	2.15	5	2.10	5	2.05	5	2.00	5	1.55	5	1.50	5	1.44	5	1.40	5	1.35	6	1.29	6	1.23	6	1.17	4	1.13
5	3.00	6	2.54	6	2.48	7	2.41	7	2.34	7	2.28	6	2.22	7	2.15	7	2.08	6	2.01	7	1.54	8	1.46	6	1.40
6	3.53	7	3.46	7	3.39	8	3.31	8	3.23	8	3.15	8	3.07	8	2.59	8	2.51	9	2.42	9	2.33	10	2.23	7	2.16
7	4.54	8	4.46	9	4.37	9	4.28	9	4.19	9	4.10	9	4.01	9	3.52	9	3.43	10	3.33	10	3.23	11	3.12	9	3.03
WE	6.00	9	5.51	9	5.42	9	5.33	9	5.24	9	5.15	10	5.05	10	4.55	10	4.45	10	4.35	10	4.25	12	4.13	9	4.04
1							6.39	8	6.31	8	6.23	9	6.14	9	6.05	10	5.55	10	5.45	10	5.35	11	5.24	8	5.16
2																	7.05	9	6.56	9	6.47	10	6.37	7	6.30

21 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.5543292	9.9701517	9.5841774	10.4158226	10.0298483	10.4456708	60
1	9.5546581	9.9701032	9.5845549	10.4154451	10.0298968	10.4453419	59
2	9.5549868	9.9700547	9.5849321	10.4150679	10.0299453	10.4450132	58
3	9.5553152	9.9700061	9.5853091	10.4146909	10.0299989	10.4446848	57
4	9.5556433	9.9699574	9.5856859	10.4143141	10.0300426	10.4443567	56
5	9.5559711	9.9699087	9.5860624	10.4139376	10.0300913	10.4440289	55
6	9.5562987	9.9698600	9.5864386	10.4135614	10.0301400	10.4437013	54
7	9.5566259	9.9698112	9.5868147	10.4131853	10.0301888	10.4433741	53
8	9.5569529	9.9697624	9.5871904	10.4128096	10.0302376	10.4430471	52
9	9.5572796	9.9697136	9.5875660	10.4124340	10.0302864	10.4427204	51
10	9.5576060	9.9696647	9.5879413	10.4120587	10.0303353	10.4423940	50
11	9.5579321	9.9696158	9.5883163	10.4116837	10.0303842	10.4420679	49
12	9.5582579	9.9695668	9.5886912	10.4113088	10.0304332	10.4417421	48
13	9.5585835	9.9695177	9.5890657	10.4109343	10.0304823	10.4414165	47
14	9.5589088	9.9694687	9.5894401	10.4105599	10.0305313	10.4410912	46
15	9.5592338	9.9694196	9.5898142	10.4101858	10.0305804	10.4407662	45
16	9.5595585	9.9693704	9.5901881	10.4098119	10.0306296	10.4404415	44
17	9.5598829	9.9693212	9.5905617	10.4094383	10.0306788	10.4401171	43
18	9.5602071	9.9692720	9.5909351	10.4090649	10.0307280	10.4397929	42
19	9.5605310	9.9692227	9.5913082	10.4086918	10.0307773	10.4394690	41
20	9.5608546	9.9691734	9.5916812	10.4083188	10.0308266	10.4391454	40
21	9.5611779	9.9691240	9.5920539	10.4579461	10.0308759	10.4388221	39
22	9.5615010	9.9690746	9.5924263	10.4075737	10.0309254	10.4384990	38
23	9.5618237	9.9690252	9.5927985	10.4072015	10.0309748	10.4381763	37
24	9.5621462	9.9689757	9.5931705	10.4068295	10.0310243	10.4378538	36
25	9.5624685	9.9689262	9.5935422	10.4064577	10.0310738	10.4375315	35
26	9.5627904	9.9688766	9.5939138	10.4060862	10.0311234	10.4372096	34
27	9.5631121	9.9688270	9.5942851	10.4057149	10.0311730	10.4368879	33
28	9.5634335	9.9687773	9.5946561	10.4053439	10.0312227	10.4365665	32
29	9.5637546	9.9687276	9.5950269	10.4049731	10.0312724	10.4362454	31
30	9.5640754	9.9686779	9.5953975	10.4046025	10.0313221	10.4359246	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

68 DEGREES.

Latitude 42 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.30	1	0.31	1	0.32	1	0.33	1	0.34	2	0.36	1	0.37	1	0.38	1	0.39	2	0.41	2	0.43	1	0.44	1	0.45
2	1.02	2	1.04	2	2.06	2	2.08	3	2.11	3	1.14	2	1.16	2	1.18	3	1.21	3	1.24	3	1.27	3	1.30	2	1.32
3	1.36	3	1.39	4	1.43	4	1.47	4	1.51	4	1.55	3	1.58	4	2.02	4	2.06	4	2.10	4	2.14	5	2.19	3	2.22
4	2.15	5	2.20	5	2.25	5	2.30	5	2.35	5	2.40	5	2.45	5	2.50	5	2.55	6	3.01	6	3.07	6	3.13	4	3.17
5	3.00	6	3.06	6	3.12	6	3.18	7	3.25	7	3.32	7	3.39	7	3.46	7	3.53	7	4.00	7	4.07	7	4.14	6	4.20
6	3.53	7	4.00	7	4.07	8	4.15	8	4.23	8	4.31	8	4.39	8	4.47	8	4.55								
7	4.54	8	5.02	8	5.10	9	5.19	9	5.28																
WE																									

21 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	3665013	9304175	3939105	25386479	10747862	27285038	30
31	3667719	9303109	3942466	25364839	10749095	27264905	29
32	3670425	9302042	3945827	25343231	10750328	27244804	28
33	3673131	9300974	3949189	25321655	10751562	27224735	27
34	3675836	9299905	3952552	25300111	10752798	27204698	26
35	3678541	9298835	3955916	25278598	10754035	27184693	25
36	3681246	9297765	3959280	25257117	10755273	27164719	24
37	3683950	9296694	3962645	25235667	10756512	27144777	23
38	3686654	9295622	3966011	25214249	10757753	27124866	22
39	3689358	9294549	3969378	25192863	10758995	27104987	21
40	3692062	9293475	3972746	25171507	10760237	27085139	20
41	3694765	9292401	3976114	25150183	10761481	27065323	19
42	3697468	9291326	3979483	25128890	10762727	27045538	18
43	3700170	9290250	3982853	25107629	10763973	27025784	17
44	3702872	9289173	3986224	25086398	10765221	27006061	16
45	3705574	9288095	3989596	25065198	10766470	26986370	15
46	3708276	9287017	3992968	25044029	10767720	26966709	14
47	3710977	9285938	3996341	25022891	10768971	26947079	13
48	3713678	9284858	3999715	25001784	10770224	26927480	12
49	3716379	9283777	4003089	24980707	10771477	26907912	11
50	3719080	9282696	4006465	24959661	10772732	26888374	10
51	3721780	9281614	4009841	24938645	10773988	26868867	9
52	3724480	9280531	4013218	24917660	10775246	26849391	8
53	3727179	9279447	4016596	24896706	10776504	26829945	7
54	3729878	9278362	4019975	24875781	10777765	26810530	6
55	3732577	9277277	4023354	24854887	10779025	26791145	5
56	3735275	9276191	4026734	24834023	10780287	26771790	4
57	3737973	9275104	4030115	24813190	10781550	26752465	3
58	3740671	9274016	4033497	24792386	10782815	26733170	2
59	3743369	9272928	4036879	24771612	10784080	26713906	1
60	3746066	9271839	4040262	24750869	10785347	26694672	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

68 DEGREES.

Latitude 43 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m	m	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	2	0.25	1	0.24	1	0.23	1	0.22	1	0.21	2	0.19	1	0.18	1	0.17
2	1.03	2	1.01	2	1.59	2	1.57	3	1.54	3	0.51	2	0.49	2	0.47	2	0.45	3	0.42	3	0.39	3	0.36	2	0.34
3	1.38	3	1.35	3	1.32	4	1.28	4	1.24	4	1.20	3	1.17	4	1.13	4	1.09	4	1.05	4	1.01	4	0.57	3	0.54
4	2.17	4	2.13	5	2.08	5	2.03	5	1.58	5	1.53	5	1.48	5	1.43	5	1.38	6	1.32	6	1.25	6	1.20	4	1.16
5	3.02	6	2.56	6	2.50	6	2.44	6	2.38	7	2.31	6	2.25	6	2.19	7	2.12	7	2.05	7	1.58	8	1.50	6	1.44
6	3.55	7	3.48	7	3.41	7	3.34	8	3.26	8	3.18	8	3.10	8	3.02	8	2.54	8	2.46	9	2.37	9	2.28	7	2.21
7	4.55	8	4.47	8	4.39	8	4.31	9	4.22	9	4.13	9	4.04	9	3.55	9	3.46	9	3.37	10	3.27	10	3.17	8	3.09
W E	6.00	8	5.52	9	5.43	9	5.34	9	5.25	9	5.16	9	5.07	10	4.57	10	4.47	10	4.37	10	4.27	10	4.17	8	4.19
1											6.23	9	6.14	9	6.05	9	5.56	9	5.47	10	5.37	10	5.27	8	5.19
2																			6.56	9	6.47	9	6.38	7	6.31

21 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.5640754	9.9686779	9.5953975	10.4046025	10.0313221	10.4359246	30
31	9.5643960	9.9686281	9.5957679	10.4042321	10.0313719	10.4356040	29
32	9.5647163	9.9685783	9.5961380	10.4038620	10.0314217	10.4352837	28
33	9.5650363	9.9685284	9.5965079	10.4034921	10.0314716	10.4349637	27
34	9.5653561	9.9684785	9.5968776	10.4031224	10.0315215	10.4346439	26
35	9.5656756	9.9684286	9.5972470	10.4027530	10.0315714	10.4343244	25
36	9.5659948	9.9683786	9.5976162	10.4023838	10.0316214	10.4340052	24
37	9.5663137	9.9683285	9.5979852	10.4020148	10.0316715	10.4336863	23
38	9.5666324	9.9682784	9.5983540	10.4016460	10.0317216	10.4333676	22
39	9.5669508	9.9682283	9.5987225	10.4012775	10.0317717	10.4330492	21
40	9.5672689	9.9681781	9.5990908	10.4009092	10.0318219	10.4327311	20
41	9.5675868	9.9681279	9.5994588	10.4005411	10.0318721	10.4324132	19
42	9.5679044	9.9680777	9.5998267	10.4001733	10.0319223	10.4320956	18
43	9.5682217	9.9680274	9.6001943	10.3998057	10.0319726	10.4317783	17
44	9.5685387	9.9679771	9.6005617	10.3994383	10.0320229	10.4314613	16
45	9.5688555	9.9679267	9.6009289	10.3990711	10.0320733	10.4311445	15
46	9.5691721	9.9678763	9.6012958	10.3987042	10.0321237	10.4308279	14
47	9.5694883	9.9678258	9.6016625	10.3983375	10.0321742	10.4305117	13
48	9.5698043	9.9677753	9.6020290	10.3979710	10.0322247	10.4301957	12
49	9.5701200	9.9677247	9.6023953	10.3976047	10.0322753	10.4298800	11
50	9.5704355	9.9676741	9.6027613	10.3972387	10.0323259	10.4295645	10
51	9.5707506	9.9676235	9.6031271	10.3968729	10.0323765	10.4292494	9
52	9.5710656	9.9675728	9.6034927	10.3965073	10.0324272	10.4289344	8
53	9.5713802	9.9675221	9.6038581	10.3961419	10.0324779	10.4286198	7
54	9.5716946	9.9674713	9.6042233	10.3957767	10.0325287	10.4283054	6
55	9.5720087	9.9674205	9.6045882	10.3954118	10.0325795	10.4279913	5
56	9.5723226	9.9673697	9.6049529	10.3950471	10.0326303	10.4276774	4
57	9.5726362	9.9673188	9.6053174	10.3946826	10.0326812	10.4273638	3
58	9.5729495	9.9672679	9.6056817	10.3943183	10.0327321	10.4270505	2
59	9.5732626	9.9672169	9.6060457	10.3939543	10.0327831	10.4267374	1
60	9.5735754	9.9671659	9.6064096	10.3935904	10.0328341	10.4264246	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

68 DEGREES.

Latitude 43 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.31	1	0.32	1	0.33	1	0.34	1	0.35	2	0.37	1	0.38	1	0.39	1	0.40	1	0.41	2	0.43	1	0.44	1	0.45
2	1.03	2	1.05	2	1.07	2	1.09	3	1.12	3	1.15	2	1.17	2	1.19	2	1.21	3	1.24	3	1.27	3	1.30	2	1.32
3	1.38	3	1.41	3	1.44	4	1.48	4	1.52	4	1.56	3	1.59	4	2.03	4	2.07	4	2.11	4	2.15	4	2.19	3	2.22
4	2.17	4	2.21	5	2.26	5	2.31	5	2.36	5	2.41	5	2.46	5	2.51	5	2.56	6	3.02	6	3.08	6	3.14	4	3.18
5	3.02	6	3.08	6	3.14	6	3.20	6	3.26	7	3.33	6	3.39	7	3.46	7	3.53	7	4.00	7	4.07	7	4.14	6	4.20
6	3.55	7	4.02	7	4.09	7	4.16	8	4.24	8	4.32	7	4.39	8	4.47	8	4.55								
7	4.55	8	5.03	8	5.11	8	5.19	9	5.28																
W E																									

22 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	3746066	9271839	4040262	24750869	10785347	26694672	60
1	3748763	9270749	4043646	24730155	10786616	26675467	59
2	3751459	9269658	4047031	24709470	10787885	26656292	58
3	3754156	9268566	4050417	24688816	10789156	26637148	57
4	3756852	9267473	4053804	24668191	10790427	26618033	56
5	3759547	9266380	4057191	24647596	10791700	26598947	55
6	3762243	9265286	4060579	24627030	10792975	26579891	54
7	3764938	9264191	4063968	24606494	10794250	26560865	53
8	3767632	9263096	4067358	24585987	10795527	26541868	52
9	3770327	9262000	4070748	24565509	10796805	26522901	51
10	3773021	9260903	4074139	24545061	10798084	26503962	50
11	3775714	9259805	4077531	24524642	10799364	26485054	49
12	3778408	9258706	4080924	24504252	10800646	26466174	48
13	3781101	9257606	4084318	24483891	10801928	26447323	47
14	3783794	9256506	4087713	24463559	10803212	26428502	46
15	3786486	9255405	4091108	24443256	10804497	26409709	45
16	3789178	9254303	4094504	24422982	10805784	26390946	44
17	3791870	9253200	4097901	24402736	10807071	26372211	43
18	3794562	9252097	4001299	24382519	10808360	26353505	42
19	3797253	9250993	4104697	24362331	10809650	26334828	41
20	3799944	9249888	4108097	24342172	10810942	26316180	40
21	3802634	9248782	4111497	24322041	10812234	26297560	39
22	3805324	9247675	4114898	24301938	10813528	26278969	38
23	3808014	9246568	4118300	24281864	10814823	26260406	37
24	3810704	9245460	4121703	24261819	10816119	26241872	36
25	3813393	9244351	4125106	24241801	10817417	26223366	35
26	3816082	9243241	4128510	24221812	10818715	26204888	34
27	3818770	9242131	4131915	24201851	10820015	26186439	33
28	3821459	9241020	4135321	24181918	10821316	26168018	32
29	3824147	9239908	4138728	24162013	10822618	26149624	31
30	3826834	9238795	4142136	24142136	10823922	26131259	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

67 DEGREES.

Latitude 44 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m	m	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	1	0.25	1	0.24	1	0.23	1	0.22	2	0.20	2	0.18	1	0.17
2	1.04	2	1.02	2	1.00	2	1.58	2	1.56	3	0.53	2	0.51	2	0.49	3	0.46	3	0.43	3	0.40	2	0.38	2	0.36
3	1.40	3	1.37	3	1.34	4	1.30	4	1.26	4	1.22	3	1.19	4	1.15	4	1.11	4	1.07	4	1.03	4	0.59	3	0.56
4	2.19	4	2.15	5	2.10	5	2.05	5	2.00	5	1.55	5	1.50	5	1.45	5	1.40	5	1.35	6	1.29	5	1.24	4	1.20
5	3.04	6	2.58	6	2.52	6	2.46	6	2.40	6	2.34	6	2.28	6	2.22	7	2.15	7	2.08	7	2.01	7	1.54	5	1.49
6	3.57	7	3.50	7	3.43	7	3.36	7	3.29	8	3.21	8	3.13	8	3.05	8	2.57	8	2.49	8	2.41	8	2.33	7	2.26
7	4.56	8	4.48	8	4.40	8	4.32	8	4.24	8	4.16	9	4.07	9	3.58	9	3.49	9	3.40	9	3.31	10	3.21	8	3.13
WE	6.00	8	5.52	8	5.44	8	5.36	9	5.27	9	5.18	9	5.09	9	5.00	9	4.51	10	4.41	10	4.31	[illegible]	4.21	8	4.13
1											6.23	8	6.15	9	6.06	9	5.57	9	5.48	9	5.39	10	5.29	8	5.21
2																			6.56	8	6.48	9	6.39	8	6.31
3																									

22 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.5735754	9.9671659	9.6064096	10.3935904	10.0328341	10.4264246	60
1	9.5738880	9.9671148	9.6067732	10.3932268	10.0328852	10.4261120	59
2	9.5742003	9.9670637	9.6071366	10.3928634	10.0329363	10.4257997	58
3	9.5745123	9.9670125	9.6074997	10.3925003	10.0329875	10.4254877	57
4	9.5748240	9.9669614	9.6078627	10.3921373	10.0330386	10.4251760	56
5	9.5751356	9.9669101	9.6082254	10.3917746	10.0330899	10.4248644	55
6	9.5754468	9.9668588	9.6085880	10.3914120	10.0331412	10.4245532	54
7	9.5757578	9.9668075	9.6089503	10.3910497	10.0331925	10.4242422	53
8	9.5760685	9.9667562	9.6093124	10.3906876	10.0332438	10.4239315	52
9	9.5763790	9.9667048	9.6096742	10.3903258	10.0332952	10.4236210	51
10	9.5766892	9.9666533	9.6100359	10.3899641	10.0333467	10.4233108	50
11	9.5769991	9.9666018	9.6103973	10.3896027	10.0333982	10.4230009	49
12	9.5773088	9.9665503	9.6107586	10.3892414	10.0334497	10.4226912	48
13	9.5776183	9.9664987	9.6111196	10.3888804	10.0335013	10.4223817	47
14	9.5779275	9.9664471	9.6114804	10.3885196	10.0335529	10.4220725	46
15	9.5782364	9.9663954	9.6118409	10.3881591	10.0336046	10.4217636	45
16	9.5785450	9.9663437	9.6122013	10.3877987	10.0336563	10.4214550	44
17	9.5788535	9.9662920	9.6125615	10.3874385	10.0337080	10.4211465	43
18	9.5791616	9.9662402	9.6129214	10.3870786	10.0337598	10.4208384	42
19	9.5794695	9.9661884	9.6132812	10.3867188	10.0338116	10.4205305	41
20	9.5797772	9.9661365	9.6136407	10.3863593	10.0338635	10.4202228	40
21	9.5800845	9.9660846	9.6140000	10.3860000	10.0339154	10.4199155	39
22	9.5803917	9.9660326	9.6143591	10.3856409	10.0339674	10.4196083	38
23	9.5806986	9.9659806	9.6147180	10.3852820	10.0340194	10.4193014	37
24	9.5810052	9.9659285	9.6150766	10.3849234	10.0340715	10.4189948	36
25	9.5813116	9.9658764	9.6154351	10.3845649	10.0341236	10.4186884	35
26	9.5816177	9.9658243	9.6157934	10.3842066	10.0341757	10.4183823	34
27	9.5819236	9.9657721	9.6161514	10.3838486	10.0342279	10.4180764	33
28	9.5822292	9.9657199	9.6165093	10.3834907	10.0342801	10.4177708	32
29	9.5825345	9.9656677	9.6168669	10.3831331	10.0343323	10.4174655	31
30	9.5828397	9.9656153	9.6172243	10.3827757	10.0343847	10.4171603	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

67 DEGREES.

Latitude 44 Deg. 00 Min. *South Declination.*

	0	d.	2	d	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.31	1	0.32	1	0.33	1	0.34	1	0.35	2	0.37	1	0.38	1	0.39	1	0.40	1	0.41	2	0.43	2	0.45	1	0.46
2	1.04	2	1.05	2	1.09	2	1.10	3	1.13	3	1.16	2	1.18	2	1.20	2	1.22	2	1.24	3	1.28	3	1.31	2	1.33
3	1.40	3	1.43	3	1.46	3	1.49	4	1.53	4	1.57	3	2.00	4	2.04	4	2.08	4	2.12	4	2.16	4	2.20	3	2.23
4	2.19	4	2.23	5	2.28	5	2.33	5	2.38	5	2.43	5	2.48	5	2.53	5	2.58	5	3.03	6	3.09	5	3.14	5	3.19
5	3.04	6	3.10	6	3.16	6	3.22	6	3.29	7	3.35	6	3.41	6	3.47	7	3.54	7	4.01	7	4.08	7	4.15	5	4.20
6	3.57	7	4.04	7	4.11	7	4.18	7	4.25	8	4.33	7	4.40	7	4.47	7	4.54								
7	4.56	8	5.04	8	5.12	8	5.20																		
WE																									

22 D E G R E E S.

M	*N. Sine.*	*N. Co-Sine.*	*N. Tangent.*	*N. Co-Tang.*	*N. Secant.*	*N. Co-Secant.*	
30	3826834	9238795	4142136	24142136	10823922	26131259	30
31	3829522	9237681	4145544	24122286	10825227	26112922	29
32	3832209	9236567	4148953	24102465	10826533	26094613	28
33	3834895	9235452	4152363	24082672	10827840	26076332	27
34	3837582	9234336	4155774	24062906	10829149	26058078	26
35	3840268	9233219	4159186	24043168	10830458	26039852	25
36	3842953	9232102	4162599	24023457	10831769	26021654	24
37	3845639	9230984	4166012	24003774	10833081	26003484	23
38	3848324	9229865	4169426	23984118	10834395	25985341	22
39	3851008	9228745	4172841	23964490	10835709	25967225	21
40	3853693	9227624	4176257	23944889	10837025	25949137	20
41	3856377	9226503	4179674	23925316	10838342	25931077	19
42	3859060	9225381	4183091	23905769	10839661	25913043	18
43	3861744	9224258	4186509	23886250	10840980	25895037	17
44	3864427	9223134	4189928	23866758	10842301	25877058	16
45	3867110	9222009	4193348	23847293	10843623	25859107	15
46	3869792	9220884	4196769	23827855	10844947	25841182	14
47	3872474	9219758	4200191	23808444	10846271	25823284	13
48	3875156	9218631	4203613	23789060	10847597	25805414	12
49	3877837	9217503	4207036	23769703	10848924	25787570	11
50	3880518	9216375	4210460	23750372	10850252	25769753	10
51	3883199	9215245	4213885	23731068	10851582	25751963	9
52	3885880	9214116	4217311	23711791	10852913	25734199	8
53	3888560	9212985	4220738	23692540	10854245	25716462	7
54	3891239	9211854	4224166	23673316	10855578	25698752	6
55	3893919	9210722	4227594	23654118	10856912	25681069	5
56	3896598	9209589	4231023	23634946	10858248	25663412	4
57	3899277	9208455	4234453	23615801	10859585	25645781	3
58	3901955	9207320	4237884	23596683	10860924	25628176	2
59	3904633	9206185	4241316	23577590	10862263	25610599	1
60	3907311	9205049	4244749	23558524	10863604	25593047	0
	N. Co-Sine.	*N. Sine.*	*N. Co-Tang.*	*N. Tangent.*	*N. Co-Secant.*	*N. Secant.*	M

67 D E G R E E S.

Latitude 45 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	2	0.26	2	0.24	1	0.23	1	0.22	1	0.21	1	0.20	1	0.19	1	0.18
2	1.05	2	1.03	2	1.01	2	0.59	2	0.57	[illegible]	0.54	3	0.51	3	0.48	2	0.46	2	0.44	2	0.42	3	0.39	2	0.37
3	1.41	3	1.38	3	1.35	3	1.32	4	1.28	4	1.24	4	1.20	4	1.16	4	1.12	4	1.08	3	1.05	4	1.01	3	0.58
4	2.21	4	2.17	4	2.13	5	2.08	5	2.03	5	1.58	5	1.53	5	1.48	5	1.43	5	1.38	5	1.33	6	1.27	4	1.23
5	3.06	5	3.01	6	2.55	6	2.49	6	2.43	6	2.37	6	2.31	6	2.25	6	2.19	7	2.12	7	2.05	7	1.58	5	1.53
6	3.59	7	3.52	7	3.45	7	3.38	7	3.31	8	3.23	7	3.16	7	3.09	8	3.01	8	2.53	8	2.45	8	2.37	7	2.30
7	4.57	7	4.50	8	4.42	8	4.34	8	4.26	8	4.18	8	4.10	8	4.02	9	3.53	9	3.44	9	3.35	9	3.26	8	3.18
WE	6.00	8	5.52	8	5.44	8	5.36	8	5.28	9	5.19	8	5.11	9	5.02	9	4.53	9	4.44	9	4.35	10	4.25	8	4.17
1											6.24	8	6.16	8	6.08	9	5.59	9	5.50	9	5.41	10	5.31	7	5.24
2																					6.48	8	6.40	7	6.33
3																									7.40

22 D E G R E E S.

M	*L. Sine.*	*L. Co-Sine.*	*L. Tangent.*	*L. Co-Tang.*	*L. Secant.*	*L. Co-Secant.*	
30	9.5828397	9.9656153	9.6172243	10.3827757	10.0343847	10.4171603	30
31	9.5831445	9.9655630	9.6175815	10.3824185	10.0344370	10.4168555	29
32	9.5834491	9.9655106	9.6179385	10.3820615	10.0344894	10.4165509	28
33	9.5837535	9.9654582	9.6182953	10.3817047	10.0345418	10.4162465	27
34	9.5840576	9.9654057	9.6186519	10.3813481	10.0345943	10.4159424	26
35	9.5843615	9.9653532	9.6190083	10.3809917	10.0346468	10.4156385	25
36	9.5846651	9.9653006	9.6193645	10.3806355	10.0346994	10.4153349	24
37	9.5849685	9.9652480	9.6197205	10.3802795	10.0347520	10.4150315	23
38	9.5852716	9.9651952	9.6200762	10.3799238	10.0348047	10.4147284	22
39	9.5855745	9.9651426	9.6204318	10.3795682	10.0348574	10.4144255	21
40	9.5858771	9.9650899	9.6207872	10.3792128	10.0349101	10.4141229	20
41	9.5861795	9.9650371	9.6211423	10.3788577	10.0349629	10.4138205	19
42	9.5864816	9.9649843	9.6214973	10.3785027	10.0350157	10.4135184	18
43	9.5867835	9.9649314	9.6218520	10.3781480	10.0350686	10.4132165	17
44	9.5870851	9.9648785	9.6222066	10.3777934	10.0351215	10.4129149	16
45	9.5873865	9.9648256	9.6225609	10.3774391	10.0351744	10.4126135	15
46	9.5876876	9.9647726	9.6229150	10.3770850	10.0352274	10.4123124	14
47	9.5879885	9.9647195	9.6232690	10.3767310	10.0352805	10.4120115	13
48	9.5882892	9.9646665	9.6236227	10.3763773	10.0353335	10.4117108	12
49	9.5885896	9.9646133	9.6239763	10.3760237	10.0353867	10.4114104	11
50	9.5888897	9.9645602	9.6243296	10.3756704	10.0354398	10.4111103	10
51	9.5891897	9.9645069	9.6246827	10.3753173	10.0354931	10.4108103	9
52	9.5894893	9.9644537	9.6250356	10.3749644	10.0355463	10.4105107	8
53	9.5897888	9.9644004	9.6253884	10.3746116	10.0355996	10.4102112	7
54	9.5900880	9.9643470	9.6257409	10.3742591	10.0356530	10.4099120	6
55	9.5903869	9.9642937	9.6260932	10.3739068	10.0357063	10.4096131	5
56	9.5906856	9.9642402	9.6264454	10.3735546	10.0357598	10.4093144	4
57	9.5909841	9.9641868	9.6267973	10.3732027	10.0358132	10.4090159	3
58	9.5912823	9.9641332	9.6271491	10.3728509	10.0358668	10.4087177	2
59	9.5915803	9.9640797	9.6275006	10.3724994	10.0359203	10.4084197	1
60	9.5918780	9.9640261	9.6278519	10.3721481	10.0359739	10.4081220	0
	L. Co-Sine.	*L. Sine.*	*L. Co-Tang.*	*L. Tangent.*	*L. Co-Secant.*	*L. Secant.*	M

67 D E G R E E S.

Latitude 45 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.32	1	0.33	1	0.34	1	0.35	1	0.36	2	0.38	2	0.40	1	0.41	1	0.42	1	0.43	1	0.44	1	0.45	1	0.46
2	1.05	2	1.07	2	1.09	2	1.11	3	1.14	3	1.17	3	1.20	3	1.23	2	1.25	2	1.27	2	1.29	2	1.31	2	1.33
3	1.41	3	1.44	3	1.47	3	1.50	4	1.54	4	1.58	4	2.02	4	2.06	4	2.10	4	2.14	3	2.17	4	2.21	3	2.24
4	2.21	4	2.24	4	2.28	5	2.33	5	2.38	5	2.44	6	2.50	5	2.55	5	3.00	5	3.05	5	3.10	5	3.15	4	3.19
5	3.06	6	3.12	6	3.18	6	3.24	6	3.30	6	3.36	7	3.43	7	3.50	6	3.56	6	4.02	6	4.08	7	4.15		
6	3.59	7	4.06	7	4.13	7	4.20	7	4.27	7	4.34	8	4.44	8	4.52	7	4.59								
7	4.57	8	5.05	8	5.13	8	5.21	8	5.29																
WE																									

23 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N.Co-Secant.	
0	3907311	9205049	4244749	23558524	10863604	25593047	60
1	3909989	9203912	4248182	23539483	10864946	25575521	59
2	3912666	9202774	4251616	23520469	10866289	25558022	58
3	3915343	9201635	4255051	23501481	10867634	25540548	57
4	3918019	9200496	4258487	23482519	10868979	25523101	56
5	3920695	9199356	4261924	23463582	10870326	25505680	55
6	3923371	9198215	4265362	23444672	10871675	25488284	54
7	3926047	9197073	4268800	23425787	10873024	25470915	53
8	3928722	9195931	4272239	23406928	10874375	25453571	52
9	3931397	9194788	4275679	23388095	10875727	25436253	51
10	3934071	9193644	4279120	23369287	10877080	25418961	50
11	3936745	9192499	4282562	23350505	10878435	25401694	49
12	3939419	9191353	4286005	23331748	10879791	25384453	48
13	3942093	9190207	4289449	23313017	10881148	25367238	47
14	3944766	9189060	4292894	23294311	10882506	25350048	46
15	3947439	9187912	4296339	23275630	10883866	25332883	45
16	3950111	9186763	4299785	23256975	10885227	25315744	44
17	3952783	9185614	4303232	23238345	10886589	25298630	43
18	3955455	9184464	4306680	23219740	10887952	25281541	42
19	3958127	9183313	4310129	23201160	10889317	25264478	41
20	3960798	9182161	4313579	23182606	10890683	25247440	40
21	3963469	9181008	4317030	23164076	10892050	25230426	39
22	3966139	9179855	4320481	23145571	10893418	25213438	38
23	3968809	9178701	4323933	23127091	10894788	25196475	37
24	3971479	9177546	4327386	23108636	10896159	25179537	36
25	3974148	9176390	4330840	23090206	10897531	25162624	35
26	3976817	9175234	4334295	23071801	10898904	25145735	34
27	3979486	9174077	4337751	23053420	10900279	25128871	33
28	3982155	9172919	4341208	23035064	10901655	25112032	32
29	3984823	9171760	4344665	23016732	10903032	25095218	31
30	3987491	9170601	4348124	22998425	10904411	25078428	30
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co Secant.	N. Secant.	M

66 DEGREES.

Latitude 46 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	1	0.25	1	0.24	1	0.23	2	0.21	1	0.20	1	0.19
2	1.06	2	1.04	2	1.02	2	1.00	2	0.58	3	0.55	2	0.53	2	0.51	2	0.49	3	0.46	3	0.43	2	0.41	2	0.39
3	1.43	3	1.40	3	1.37	3	1.34	4	1.30	4	1.26	3	1.23	3	1.20	4	1.16	4	1.12	4	1.08	4	1.04	3	1.01
4	2.23	4	2.19	4	2.15	5	2.10	5	2.05	5	2.00	4	1.56	5	1.51	5	1.46	5	1.41	5	1.36	6	1.30	4	1.26
5	3.08	5	3.03	5	2.58	6	2.52	6	2.46	6	2.40	6	2.34	6	2.28	6	2.22	6	2.16	7	2.09	7	2.02	5	1.57
6	4.00	6	3.54	7	3.47	7	3.40	7	3.33	7	3.26	7	3.19	7	3.12	7	3.05	8	2.57	8	2.49	8	2.41	6	2.35
7	4.58	7	4.51	7	4.44	8	4.36	8	4.28	8	4.20	8	4.12	8	4.0[illegible]	8	3.56	8	3.48	9	3.39	9	3.30	7	3.25
WE	6.00	8	5.52	8	5.44	8	5.36	8	5.28	8	5.20	8	5.12	9	5.0[illegible]	8	4.56	9	4.47	9	4.38	10	4.28	7	4.21
1											6.24	8	6.16	8	6.0[illegible]	8	6.00	8	5.52	9	5.43	10	5.33	7	5.26
2																					6.49	8	6.41	7	6.34
3																									7.40

23 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.5918780	9.9640261	9.6278519	10.3721481	10.0359739	10.4081220	60
1	9.5921755	9.9639724	9.6282031	10.3717969	10.0360276	10.4078243	59
2	9.5924728	9.9639187	9.6285540	10.3714460	10.0360813	10.4075272	58
3	9.5927698	9.9638650	9.6289048	10.3710952	10.0361350	10.4072302	57
4	9.5930666	9.9638112	9.6292553	10.3707447	10.0361888	10.4069334	56
5	9.5933631	9.9637574	9.6296057	10.3703943	10.0362426	10.4066369	55
6	9.5936594	9.9637036	9.6299558	10.3700442	10.0362964	10.4063406	54
7	9.5939555	9.9636496	9.6303058	10.3696942	10.0363504	10.4060445	53
8	9.5942513	9.9635957	9.6306556	10.3693444	10.0364043	10.4057487	52
9	9.5945469	9.9635417	9.6310052	10.3689948	10.0364583	10.4054531	51
10	9.5948422	9.9634877	9.6313545	10.3686455	10.0365123	10.4051578	50
11	9.5951373	9.9634336	9.6317037	10.3682963	10.0365664	10.4048627	49
12	9.5954322	9.9633795	9.6320527	10.3679473	10.0366205	10.4045678	48
13	9.5957268	9.9633253	9.6324015	10.3675985	10.0366747	10.4042732	47
14	9.5960212	9.9632711	9.6327501	10.3672499	10.0367289	10.4039788	45
15	9.5963154	9.9632168	9.6330985	10.3669015	10.0367832	10.4036846	45
16	9.5966093	9.9631625	9.6334468	10.3665532	10.0368375	10.4033907	44
17	9.5969030	9.9631082	9.6337948	10.3662052	10.0368918	10.4030970	43
18	9.5971965	9.9630538	9.6341426	10.3658574	10.0369462	10.4028035	42
19	9.5974897	9.9629994	9.6344903	10.3655097	10.0370006	10.4025103	41
20	9.5977827	9.9629449	9.6348378	10.3651622	10.0370551	10.4022175	40
21	9.5980754	9.9628904	9.6351850	10.3648150	10.0371096	10.4019246	39
22	9.5983679	9.9628358	9.6355321	10.3644679	10.0371642	10.4016321	38
23	9.5986602	9.9627812	9.6358790	10.3641210	10.0372188	10.4013398	37
24	9.5989523	9.9627266	9.6362257	10.3637743	10.0372734	10.4010477	36
25	9.5992441	9.9626719	9.6365722	10.3634278	10.0373281	10.4007559	35
26	9.5995357	9.9626172	9.6369185	10.3630815	10.0373828	10.4004643	34
27	9.5998271	9.9625624	9.6372646	10.3627354	10.0374376	10.4001730	33
28	9.6001181	9.9625076	9.6376106	10.3623894	10.0374924	10.3998819	32
29	9.6004090	9.9624527	9.6379563	10.3620437	10.0375473	10.3995910	31
30	9.6006997	9.9623978	9.6383019	10.3616981	10.0376022	10.3993003	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

66 DEGREES.

Latitude 46 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.33	1	0.34	1	0.35	1	0.36	1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	2	0.44	1	0.45	1	0.46
2	1.06	2	1.08	2	1.10	2	1.12	3	1.15	3	1.18	2	[illegible]	2	1.22	2	1.24	2	1.26	3	1.29	3	1.32	2	1.34
3	1.43	3	1.46	3	1.49	3	1.52	4	1.56	4	2.00	3	[illegible]	3	2.06	4	2.10	4	2.14	4	2.18	4	2.22	3	2.25
4	2.23	4	2.27	4	2.31	5	2.36	5	2.41	5	2.46	4	[illegible]	5	2.55	5	3.00	5	3.05	5	3.10	6	3.16	4	3.20
5	3.08	5	3.13	6	3.19	6	3.25	6	3.31	6	3.37	6	[illegible]	6	3.49	6	3.55	6	4.01	7	4.08	7	4.15		
6	4.00	6	4.06	7	4.13	7	4.20	7	4.27	7	4.34	7	4.41												
7	4.58	7	5.05	8	5.13	8	5.21																		
WE																									

23 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	3987491	9170601	4348124	22998425	10904411	25078428	30
31	3990158	9169441	4351583	22980143	10905791	25061663	29
32	3992825	9168280	4355043	22961885	10907172	25044923	28
33	3995492	9167118	4358504	22943651	10908554	25028207	27
34	3998158	9165955	4361966	22925442	10909938	25011515	26
35	3000824	9164791	4365429	22907257	10911323	24994847	25
36	3003490	9163627	4368893	22889096	10912709	24978204	24
37	4006156	9162462	4372358	22870959	10914097	24961586	23
38	4008821	9161296	4375823	22852846	10915486	24944991	22
39	4011486	9160130	4379289	22834758	10916876	24928421	21
40	4014150	9158963	4382756	22816693	10918267	24911874	20
41	4016814	9157795	4386224	22798653	10919659	24895352	19
42	4019478	9156626	4389693	22780636	10921053	24878854	18
43	4022141	9155456	4393163	22762643	10922448	24862380	17
44	4024804	9154286	4396634	22744674	10923845	24845929	16
45	4027467	9153115	4400106	22726729	10925243	24829503	15
46	4030129	9151943	4403578	22708807	10926642	24813100	14
47	4032791	9150770	4407051	22690909	10928042	24796721	13
48	4035453	9149596	4410525	22673035	10929444	24780366	12
49	4038114	9148422	4414000	22655184	10930847	24764034	11
50	4040775	9147247	4417476	22637357	10932251	24747726	10
51	4043436	9146071	4420953	22619553	10933656	24731442	9
52	4046096	9144895	4424431	22601773	10935063	24715181	8
53	4048756	9143718	4427910	22584016	10936471	24698943	7
54	4051416	9142540	4431390	22566283	10937880	24682729	6
55	4054075	9141361	4434871	22548572	10939291	24666538	5
56	4056734	9140181	4438353	22530885	10940703	24650371	4
57	4059393	9139000	4441835	22513221	10942116	24634227	3
58	4062051	9137819	4445318	22495580	10943530	24618106	2
59	4064709	9136637	4448802	22477962	10944946	24602008	1
60	4067366	9135454	4452287	22460368	10946363	24585933	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co Secant.	N. Secant.	M

66 DEGREES.

Latitude 47 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d	8	d	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	2	0.26	1	0.25	1	0.24	1	0.23	1	0.22	1	0.21	1	0.20
2	1.07	2	1.05	2	1.03	2	1.01	2	0.59	2	0.57	3	0.54	2	0.52	2	0.50	2	0.48	3	0.45	3	0.42	2	0.40
3	1.44	4	1.40	3	1.37	3	1.34	3	1.31	4	1.27	4	1.23	3	1.20	3	1.17	3	1.14	4	1.10	4	1.06	3	1.03
4	2.25	6	2.19	4	2.15	4	2.11	4	2.07	5	2.02	5	1.57	4	1.53	5	1.48	5	1.43	5	1.38	5	1.33	4	1.29
5	3.10	7	3.03	5	2.58	5	2.53	6	2.47	6	2.41	6	2.35	5	2.30	6	2.25	6	2.20	6	2.14	6	2.06	5	2.01
6	4.02	8	3.54	6	3.48	7	3.41	7	3.34	7	3.27	7	3.20	7	3.13	7	3.06	7	2.59	7	2.52	7	2.45	6	2.39
7	4.59	9	4.50	7	4.43	7	4.36	7	4.29	8	4.21	8	4.13	7	4.06	8	3.58	8	3.50	8	3.42	8	3.34	7	3.27
WE	6.00	9	5.51	7	5.44	8	5.36	8	5.28	8	5.20	8	5.12	8	5.04	8	4.56	8	4.48	8	4.40	9	4.31	7	4.24
1											6.22	7	6.15	7	6.08	8	6.00	8	5.52	8	5.44	8	5.36	7	5.29
2																					6.49	7	6.42	7	6.35
3																									7.40

23 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.6006997	9.9623978	9.6383019	10.3616981	10.0376022	10.3993003	30
31	9.6009901	9.9623428	9.6386473	10.3613527	10.0376572	10.3990099	29
32	9.6012803	9.9622878	9.6389925	10.3610075	10.0377122	10.3987197	28
33	9.6015703	9.9622328	9.6393375	10.3606625	10.0377672	10.3984297	27
34	9.6018600	9.9621777	9.6396823	10.3603177	10.0378223	10.3981400	26
35	9.6021495	9.9621226	9.6400269	10.3599731	10.0378774	10.3978505	25
36	9.6024388	9.9620674	9.6403714	10.3596286	10.0379326	10.3975612	24
37	9.6027278	9.9620122	9.6407156	10.3592844	10.0379878	10.3972722	23
38	9.6030165	9.9619569	9.6410597	10.3589403	10.0380431	10.3969834	22
39	9.6033052	9.9619016	9.6414036	10.3585964	10.0380984	10.3966948	21
40	9.6035936	9.9618463	9.6417473	10.3582527	10.0381537	10.3964064	20
41	9.6038817	9.9617909	9.6420908	10.3579092	10.0382091	10.3961183	19
42	9.6041696	9.9617355	9.6424342	10.3575658	10.0382645	10.3958304	18
43	9.6044573	9.9616800	9.6427773	10.3572228	10.0383200	10.3955427	17
44	9.6047448	9.9616245	9.6431203	10.3568797	10.0383755	10.3952522	16
45	9.6050320	9.9615689	9.6434631	10.3565369	10.0384311	10.3949680	15
45	9.6053190	9.9615133	9.6438057	10.3561943	10.0384867	10.3946810	14
47	9.6056057	9.9614576	9.6441481	10.3558519	10.0385424	10.3943943	13
48	9.6058923	9.9614020	9.6444903	10.3555097	10.0385980	10.3941077	12
49	9.6061786	9.9613463	9.6448324	10.3551676	10.0386538	10.3938214	11
50	9.6064647	9.9612904	9.6451743	10.3548257	10.0387096	10.3935353	10
51	9.6067506	9.9612346	9.6455160	10.3544840	10.0387654	10.3932494	9
52	9.6070362	9.9611787	9.6458575	10.3541425	10.0388213	10.3929638	8
53	9.6073216	9.9611228	9.6461988	10.3538012	10.0388772	10.3926784	7
54	9.6076068	9.9610668	9.6465400	10.3534600	10.0389332	10.3923932	6
55	9.6078918	9.9610108	9.6468810	10.3531190	10.0389892	10.3921082	5
56	9.6081765	9.9609548	9.6472217	10.3527783	10.0390452	10.3918235	4
57	9.6084611	9.9608987	9.6475624	10.3524376	10.0391013	10.3915389	3
58	9.6087454	9.9608426	9.6479028	10.3520972	10.0391574	10.3912546	2
59	9.6090294	9.9607864	9.6482431	10.3517569	10.0392136	10.3909706	1
60	9.6093133	9.9607302	9.6485831	10.3514169	10.0392698	10.3906867	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

66 DEGREES.

Latitude 47 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.33	1	0.34	1	0.35	1	0.36	1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	1	0.43	2	0.45	1	0.46
2	1.07	3	1.10	2	1.12	2	1.14	2	1.16	2	1.18	3	1.21	2	1.23	2	1.25	2	1.27	2	1.29	3	1.32	2	1.34
3	1.44	4	1.48	3	1.51	3	1.54	3	1.57	4	2.01	4	2.05	[illegible]	2.08	3	2.11	3	2.14	4	2.18	4	2.22	3	2.25
4	2.25	5	2.30	4	2.34	4	2.38	5	2.43	5	2.48	5	2.53	4	2.57	4	3.01	5	3.06	5	3.11	5	3.16	4	3.20
5	3.10	7	3.17	5	3.22	5	3.27	6	3.33	6	3.39	6	3.45	6	3.51	6	3.57	6	4.03	6	4.09	6	4.15		
6	4.02	8	4.10	6	4.16	6	4.22	7	4.29	7	4.36	7	4.43												
7	4.59	9	5.08	7	5.15																				
WE																									

24 DEGREES.

M	*N. Sine.*	*N. Co-Sine.*	*N. Tangent.*	*N. Co-Tang.*	*N. Secant.*	*N. Co-Secant.*	
0	4067366	9135454	4452287	22460368	10946363	24585933	60
1	4070023	9134271	4455773	22442796	10947781	24569882	59
2	4072680	9133087	4459260	22425247	10949201	24553853	58
3	4075337	9131902	4462748	22407721	10950622	24537848	57
4	4077993	9130716	4466237	22390218	10952044	24521865	56
5	4080649	9129529	4469727	22372738	10953467	24505905	55
6	4083305	9128342	4473217	22355280	10954892	24489968	54
7	4085960	9127154	4476708	22337845	10956318	24474054	53
8	4088615	9125965	4480200	22320433	10957746	24458163	52
9	4091269	9124775	4483693	22303043	10959174	24442294	51
10	4093923	9123584	4487187	22285676	10960604	24426448	50
11	4096577	9122393	4490682	22268331	10962036	24410624	49
12	4099230	9121201	4494178	22251009	10963468	24394823	48
13	4101883	9120008	4497675	22233709	10964902	24379045	47
14	4104536	9118814	4501173	22216432	10966337	24363289	46
15	4107189	9117620	4504672	22199177	10967774	24347555	45
16	4109841	9116425	4508172	22181944	10969212	24331844	44
17	4112493	9115229	4511673	22164733	10970651	24316155	43
18	4115144	9114032	4515174	22147545	10972091	24300489	42
19	4117795	9112835	4518676	22130379	10973533	23284844	41
20	4120446	9111637	4522179	22113234	10974976	24269222	40
21	4123096	9110438	4525683	22096112	10976420	24253622	39
22	4125746	9109238	4529188	22079012	10977866	24238044	38
23	4128395	9108038	4532694	22061934	10979313	24222488	37
24	4131044	9106837	4536201	22044878	10980761	24206954	36
25	4133693	9105635	4539709	22027843	10982211	24191442	35
26	4136342	9104432	4543218	22010831	10983662	24175952	34
27	4138990	9103228	4546728	21993840	10985114	24160484	33
28	4141638	9102024	4550239	21976871	10986568	24145038	32
29	4144285	9100819	4553751	21959923	10988023	24129613	31
30	4146932	9099613	4557264	21942997	10989479	24114210	30
	N. Co-Sine.	*N. Sine.*	*N. Co-Tang.*	*N. Tangent.*	*N. Co-Secant.*	*N. Secant.*	M

65 DEGREES.

24 DEGREES.

M	*L. Sine.*	*L. Co-Sine.*	*L. Tangent.*	*L. Co-Tang.*	*L. Secant.*	*L. Co-Secant.*	
0	9.6093133	9.9607302	9.6485831	10.3514169	10.0392698	10.3906867	60
1	9.6095969	9.9606739	9.6489230	10.3510770	10.0393261	10.3904031	59
2	9.6098803	9.9606176	9.6492628	10.3507372	10.0393824	10.3901197	58
3	9.6101635	9.9605612	9.6496023	10.3503977	10.0394388	10.3898365	57
4	9.6104465	9.9605048	9.6499417	10.3500583	10.0394952	10.3895535	56
5	9.6107293	9.9604484	9.6502809	10.3497191	10.0395516	10.3892707	55
6	9.6110118	9.9603919	9.6506199	10.3493801	10.0396081	10.3889882	54
7	9.6112941	9.9603354	9.6509587	10.3490413	10.0396646	10.3887059	53
8	9.6115762	9.9602788	9.6512974	10.3487026	10.0397212	10.3884238	52
9	9.6118580	9.9602222	9.6516359	10.3483641	10.0397778	10.3881420	51
10	9.6121397	9.9601655	9.6519742	10.3480258	10.0398345	10.3878603	50
11	9.6124211	9.9601088	9.6523123	10.3476877	10.0398912	10.3875789	49
12	9.6127023	9.9600520	9.6526503	10.3473497	10.0399480	10.3872977	48
13	9.6129833	9.9599952	9.6529881	10.3470119	10.0400048	10.3870167	47
14	9.6132641	9.9599384	9.6533257	10.3466743	10.0400616	10.3867359	46
15	9.6135446	9.9598815	9.6536631	10.3463369	10.0401185	10.3864554	45
16	9.6138250	9.9598246	9.6540004	10.3459996	10.0401754	10.3861750	44
17	9.6141051	9.9597676	9.6543375	10.3456625	10.0402324	10.3858949	43
18	9.6143850	9.9597106	9.6546744	10.3453256	10.0402894	10.3856150	42
19	9.6146647	9.9596535	9.6550112	10.3449888	10.0403465	10.3853353	41
20	9.6149441	9.9595964	9.6553477	10.3446523	10.0404036	10.3850559	40
21	9.6152234	9.9595393	9.6556841	10.3443159	10.0404607	10.3847766	39
22	9.6155024	9.9594821	9.6560204	10.3439796	10.0405179	10.3844976	38
23	9.6157812	9.9594248	9.6563564	10.3436436	10.0405752	10.3842188	37
24	9.6160598	9.9593675	9.6566923	10.3433077	10.0406325	10.3839401	36
25	9.6163382	9.9593102	9.6570280	10.3429720	10.0406898	10.3836618	35
26	9.6166164	9.9592528	9.6573636	10.3426364	10.0407472	10.3833836	34
27	9.6168944	9.9591954	9.6576989	10.3423011	10.0408046	10.3831056	33
28	9.6171721	9.9591380	9.6580341	10.3419659	10.0408620	10.3828279	32
29	9.6174496	9.9590805	9.6583692	10.3416308	10.0409195	10.3825504	31
30	9.6177270	9.9590229	9.6587041	10.3412959	10.0409771	10.3822730	30
	L. Co-Sine.	*L. Sine.*	*L. Co-Tang.*	*L. Tangent.*	*L. Co-Secant.*	*L. Secant.*	M

65 DEGREES.

Latitude 48 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.34	2	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	1	0.25	1	0.24	1	0.23	1	0.22	1	0.21
2	1.08	2	1.06	2	1.04	2	1.02	2	1.00	2	0.58	3	0.55	2	0.53	2	0.51	2	0.49	3	0.46	2	0.44	2	0.42
3	1.46	4	1.42	3	1.39	3	1.36	3	1.33	3	1.30	5	1.25	3	1.22	3	1.19	3	1.16	4	1.12	4	1.08	3	1.05
4	2.26	5	2.21	4	2.17	4	2.13	4	2.09	4	2.05	6	1.59	4	1.55	4	1.51	4	1.47	6	1.41	5	1.36	4	1.32
5	3.12	7	3.05	5	3.00	5	2.55	5	2.50	5	2.45	6	2.39	5	2.34	5	2.29	6	2.23	7	2.16	7	2.09	5	2.04
6	4.03	7	3.56	6	3.50	6	3.44	6	3.38	6	3.32	9	3.23	6	3.17	6	3.11	7	3.04	7	2.57	8	2.49	6	2.43
7	5.00	9	4.51	6	4.45	6	4.39	7	4.32	7	4.25	9	4.16	7	4.09	7	4.02	8	3.54	8	3.46	8	3.38	7	3.31
W E	6.00	9	5.51	7	5.44	7	5.37	7	5.30	7	5.23	9	5.14	7	5.07	8	4.59	8	4.51	8	4.43	8	4.35	7	4.28
1										6	5.25	9	6.16	7	6.09	7	6.02	8	5.54	8	5.46	8	5.38	7	5.31
2																			6.58	8	6.50	8	6.42	6	6.36
3																							7.45	5	7.40

Latitude 48 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*	*m.*	*h. m.*
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.34	1	0.35	1	0.36	1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	1	0.43	2	0.45	2	0.47	0	0.47
2	1.08	3	1.11	3	1.14	2	1.16	2	1.18	2	1.20	2	1.22	2	1.24	2	1.26	2	1.28	2	1.30	3	1.33	2	1.35
3	1.46	4	1.50	4	1.54	3	1.57	3	2.00	3	2.03	3	2.06	3	2.09	3	2.12	3	2.15	4	2.19	4	2.23	3	2.26
4	2.26	6	2.32	5	2.37	5	2.42	4	2.46	4	2.50	4	2.54	4	2.58	4	3.02	5	3.07	5	3.12	5	3.17	4	3.21
5	3.12	7	3.19	6	3.25	5	3.30	5	3.35	5	3.40	5	3.45	5	3.50										
6	4.03	8	4.11	7	4.18	7	4.25	7	4.32	6	4.38	6	4.44												
7	5.00	9	5.09	7	5.16																				
W E																									
1																									
2																									
3																									

24 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	4146932	9099613	4557264	21942997	10989479	24114210	30
31	4149579	9098406	4560777	21926093	10990936	24098829	29
32	4152226	9097198	4564291	21909210	10992395	24083469	28
33	4154872	9095990	4567806	21892349	10993855	24068132	27
34	4157518	9094781	4571322	21875510	10995317	24052815	26
35	4160163	9093571	4574839	21858691	10996779	24037520	25
36	4162808	9092361	4578357	21841894	10998243	24022247	24
37	4165453	9091150	4581876	21825119	10999709	24006995	23
38	4168097	9089938	4585396	21808364	11001176	23991764	22
39	4170741	9088725	4588917	21791631	11002644	23976555	21
40	4173385	9087511	4592439	21774920	11004113	23961367	20
41	4176028	9086297	4595962	21758229	11005584	23946201	19
42	4178671	9085082	4599486	21741559	11007056	23931055	18
43	4181313	9083866	4603011	21724911	11008529	23915931	17
44	4183955	9082649	4606537	21708283	11010004	23900828	16
45	4186597	9081432	4610064	21691677	11011480	23885746	15
46	4189239	9080214	4613591	21675091	11012957	23870685	14
47	4191880	9078995	4617119	21658527	11014436	23855645	13
48	4194521	9077775	4620648	21641983	11015916	23840625	12
49	4197161	9076554	4624178	21625460	11017397	23825627	11
50	4199801	9075333	4627709	21608958	11018879	23810650	10
51	4202441	9074111	4631242	21592476	11020363	23795693	9
52	4205080	9072888	4634776	21576015	11021849	23780758	8
53	4207719	9071664	4638311	21559575	11023335	23765843	7
54	4210358	9070440	4641846	21543156	11024823	23750949	6
55	4212996	9069215	4645382	21526757	11026313	23736075	5
56	4215634	9067989	4648919	21510378	11027803	23721222	4
57	4218272	9066762	4652457	21494020	11029295	23706390	3
58	4220909	9065535	4655996	21477683	11030789	23691578	2
59	4223546	9064307	4659536	21461366	11032283	23676787	1
60	4226183	9063078	4663077	21445069	11033779	23662016	0
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N.Tangent.	N.Co-Secant.	N. Secant.	M

65 DEGREES.

Latitude 49 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	1	0.25	2	0.23	1	0.22	1	0.21
2	1.09	2	1.07	2	1.05	2	1.03	2	1.01	2	0.59	2	0.57	2	0.55	2	0.53	2	0.51	3	0.48	2	0.46	2	0.44
3	1.47	3	1.44	3	1.41	3	1.38	3	1.35	4	1.31	3	1.28	3	1.25	3	1.22	4	1.18	4	1.14	3	1.11	3	1.08
4	2.28	4	2.24	4	2.20	4	2.16	4	2.12	5	2.07	4	2.03	4	1.59	5	1.54	5	1.49	5	1.44	5	1.39	4	1.35
5	3.14	5	3.09	5	3.04	5	2.59	5	2.54	6	2.48	5	2.43	6	2.37	6	2.31	6	2.25	6	2.19	6	2.13	5	2.08
6	4.05	6	3.59	6	3.53	6	3.47	6	3.41	7	3.34	6	3.28	7	3.21	7	3.14	7	3.07	7	3.00	7	2.53	6	2.47
7	5.01	6	4.55	7	4.48	7	4.41	7	4.34	7	4.27	7	4.20	7	4.13	7	4.06	8	3.58	8	3.50	8	3.42	7	3.35
WE	6.00	7	5.53	7	5.46	7	5.39	7	5.32	7	5.25	7	5.18	8	5.10	8	5.02	8	4.54	8	4.46	8	4.38	7	4.31
1									6.32	7	6.25	7	6.18	7	6.11	7	6.04	8	5.56	8	5.48	8	5.40	6	5.34
2																	7.07	8	6.59	8	6.51	8	6.43	5	6.38
3																							7.45	5	7.40

24 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.6177270	9.9590229	9.6587041	10.3412960	10.0409771	10.3822730	30
31	9.6180041	9.9589653	9.6590387	10.3409613	10.0410347	10.3819959	29
32	9.6182809	9.9589077	9.6593733	10.3406267	10.0410923	10.3817191	28
33	9.6185576	9.9588500	9.6597076	10.3402924	10.0411500	10.3814424	27
34	9.6188341	9.9587923	9.6600418	10.3399582	10.0412077	10.3811659	26
35	9.6191103	9.9587345	9.6603758	10.3396242	10.0412655	10.3808897	25
36	9.6193864	9.9586767	9.6607097	10.3392903	10.0413233	10.3806136	24
37	9.6196622	9.9586188	9.6610434	10.3389566	10.0413812	10.3803378	23
38	9.6199378	9.9585609	9.6613769	10.3386231	10.0414391	10.3800622	22
39	9.6202132	9.9585030	9.6617103	10.3382897	10.0414970	10.3797868	21
40	9.6204884	9.9584450	9.6620434	10.3379566	10.0415550	10.3795116	20
41	9.6207634	9.9583869	9.6623765	10.3376235	10.0416131	10.3792366	19
42	9.6210382	9.9583288	9.6627093	10.3372907	10.0416712	10.3789618	18
43	9.6213127	9.9582707	9.6630420	10.3369580	10.0417293	10.3786837	17
44	9.6215871	9.9582125	9.6633745	10.3366255	10.0417875	10.3784129	16
45	9.6218612	9.9581543	9.6637069	10.3362931	10.0418457	10.3781388	15
46	9.6221351	9.9580961	9.6640391	10.3359609	10.0419039	10.3778649	14
47	9.6224088	9.9580378	9.6643711	10.3356289	10.0419622	10.3775912	13
48	9.6226824	9.9579794	9.6647030	10.3352970	10.0420206	10.3773176	12
49	9.6229557	9.9579210	9.6650346	10.3349654	10.0420790	10.3770443	11
50	9.6232287	9.9578626	9.6653662	10.3346338	10.0421374	10.3767713	10
51	9.6235016	9.9578041	9.6656975	10.3343025	10.0421959	10.3764984	9
52	9.6237743	9.9577456	9.6660288	10.3339712	10.0422544	10.3762257	8
53	9.6240467	9.9576870	9.6663598	10.3336402	10.0423130	10.3759532	7
54	9.6243190	9.9576284	9.6666907	10.3333093	10.0423716	10.3756810	6
55	9.6245911	9.9575697	9.6670214	10.3329786	10.0424303	10.3754089	5
56	9.6248629	9.9575110	9.6673519	10.3326481	10.0424890	10.3751371	4
57	9.6251346	9.9574522	9.6676823	10.3323177	10.0425478	10.3748654	3
58	9.6254060	9.9573934	9.6680126	10.3319874	10.0426066	10.3745940	2
59	9.6256772	9.9573346	9.6683426	10.3316574	10.0426654	10.3743228	1
60	9.6259483	9.9572757	9.6686725	10.3313275	10.0427243	10.3740517	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

65 DEGREES.

Latitude 49 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.34	1	0.35	1	0.36	1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	1	0.43	2	0.45	1	0.46	1	0.47
2	1.08	2	1.11	2	1.13	2	1.15	2	1.17	3	1.20	2	1.22	2	1.24	2	1.26	2	1.28	3	1.31	2	1.33	2	1.35
3	1.47	3	1.50	3	1.53	3	1.56	3	1.59	4	2.03	3	2.06	3	2.09	3	2.12	4	2.16	4	2.20	3	2.23	3	2.26
4	2.26	4	2.30	4	2.34	5	2.39	5	2.44	5	2.49	4	2.53	4	2.57	5	3.02	5	3.07	5	3.12	5	3.17	4	3.21
5	3.14	5	3.19	5	3.24	5	3.29	5	3.34	6	3.40	5	3.45	6	3.51	6	3.57	6	4.03	6	4.09				
6	4.05	6	4.11	6	4.17	6	4.23	6	4.29	7	4.36	6	4.42												
7	5.01	7	5.08	7	5.15																				
WE																									

25 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	4226183	9063078	4663077	21445069	11033779	23662016	60
1	4228819	9061848	4666619	21428793	11035277	23647265	59
2	4231455	9060617	4670162	21412537	11036775	23632535	58
3	4234090	9059386	4673706	21396301	11038275	23617826	57
4	4236725	9058154	4677251	21380085	11039777	23603136	56
5	4239360	9056921	4680797	21363889	11041279	23588467	55
6	4241994	9055688	4684343	21347714	11042783	23573818	54
7	4244628	9054454	4687890	21331559	11044289	23559189	53
8	4247262	9053219	4691438	21315423	11045795	23544581	52
9	4249895	9051983	4694988	21299308	11047303	23529992	51
10	4252528	9050746	4698539	21283213	11048813	23515424	50
11	4255161	9049509	4702090	21267137	11050324	23500875	49
12	4257793	9048271	4705643	21251082	11051836	23486347	48
13	4260425	9047032	4709196	21235045	11053349	23471838	47
14	4263056	9045792	4712751	21219030	11054864	23457349	46
15	4265687	9044551	4716306	21203034	11056380	23442880	45
16	4268318	9043310	4719863	21187057	11057898	23428431	44
17	4270949	9042068	4723420	21171101	11059417	23414002	43
18	4273579	9040825	4726978	21155164	11060937	23399593	42
19	4276209	9039582	4730538	21139246	11062458	23385203	41
20	4278838	9038338	4734098	21123348	11063981	23370833	40
21	4281467	9037093	4737659	21107470	11065506	23356482	39
22	4284095	9035847	4741222	21091611	11067031	23342152	38
23	4286723	9034600	4744785	21075771	11068558	23327840	37
24	4289351	9033353	4748349	21059951	11070087	23313548	36
25	4291979	9032105	4751914	21044150	11071616	23299276	35
26	4294606	9030856	4755481	21028369	11073147	23285023	34
27	4297233	9029606	4759048	21012607	11074680	23270790	33
28	4299859	9028356	4762616	20996864	11076214	23256575	32
29	4802485	9027105	4766185	20981140	11077749	23242381	31
30	4305111	9025853	4769755	20965436	11079285	23228205	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co Secant.	N. Secant.	M

64 DEGREES.

Latitude 50 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.35	1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	2	0.24	1	0.23	1	0.22
2	1.10	2	1.08	2	1.06	2	1.04	2	1.02	2	1.00	2	0.58	2	0.56	2	0.54	2	0.52	3	0.49	2	0.47	2	0.45
3	1.48	3	1.45	3	1.42	3	1.39	3	1.36	3	1.33	3	1.30	3	1.27	3	1.24	4	1.20	4	1.16	3	1.13	3	1.10
4	2.30	4	2.26	4	2.22	4	2.18	4	2.14	5	2.09	4	2.05	4	2.01	4	1.57	5	1.52	5	1.47	5	1.42	4	1.38
5	3.16	5	3.11	5	3.06	5	3.01	5	2.56	6	2.50	5	2.45	5	2.40	5	2.35	6	2.29	6	2.23	7	2.16	4	2.12
6	4.06	6	4.00	6	3.54	6	3.48	6	3.42	6	3.36	6	3.30	6	3.24	6	3.18	7	3.11	7	3.04	7	2.57	6	2.51
7	5.02	6	4.56	6	4.50	7	4.43	7	4.36	7	4.29	7	4.22	7	4.15	7	4.08	7	4.01	8	3.53	8	3.45	7	3.39
WE	6.00	6	5.54	7	5.47	7	5.40	7	5.33	7	5.26	7	5.19	7	5.12	7	5.05	8	4.57	8	4.49	8	4.41	7	4.34
1									6.32	7	6.25	7	6.13	7	6.11	7	6.04	7	5.57	8	5.49	7	5.42	6	5.36
2																	7.06	7	6.59	8	6.51	7	6.44	5	6.39
3																							7.45	4	7.41

25 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.6259483	9.9572757	9.6686725	10.3313275	10.0427243	10.3740517	60
1	9.6262191	9.9572168	9.6690023	10.3309977	10.0427832	10.3737809	59
2	9.6264897	9.9571578	9.6693319	10.3306681	10.0428422	10.3735103	58
3	9.6267601	9.9570988	9.6696613	10.3303387	10.0429012	10.3732399	57
4	9.6270303	9.9570397	9.6699906	10.3300094	10.0429603	10.3729697	56
5	9.6273003	9.9569805	9.6703197	10.3296803	10.0430194	10.3726997	55
6	9.6275701	9.9569215	9.6706486	10.3293514	10.0430785	10.3724299	54
7	9.6278397	9.9568623	9.6709774	10.3290226	10.0431377	10.3721603	53
8	9.6281090	9.9568030	9.6713060	10.3286940	10.0431970	10.3718910	52
9	9.6283782	9.9567437	9.6716345	10.3283655	10.0432563	10.3716218	51
10	9.6286472	9.9566844	9.6719628	10.3280372	10.0433156	10.3713528	50
11	9.6289160	9.9566250	9.6722910	10.3277090	10.0433750	10.3710840	49
12	9.6291845	9.9565656	9.6726190	10.3273810	10.0434344	10.3708155	48
13	9.6294529	9.9565061	9.6729468	10.3270532	10.0434939	10.3705471	47
14	9.6297211	9.9564466	9.6732745	10.3267255	10.0435534	10.3702789	46
15	9.6299890	9.9563870	9.6736020	10.3263980	10.0436130	10.3700110	45
16	9.6302568	9.9563274	9.6739294	10.3260706	10.0436726	10.3697432	44
17	9.6305243	9.9562678	9.6742566	10.3257434	10.0437322	10.3694757	43
18	9.6307917	9.9562081	9.6745836	10.3254164	10.0437919	10.3692083	42
19	9.6310589	9.9561483	9.6749105	10.3250895	10.0438517	10.3689411	41
20	9.6313258	9.9560886	9.6752372	10.3247628	10.0439114	10.3686742	40
21	9.6315926	9.9560287	9.6755638	10.3244362	10.0439713	10.3684074	39
22	9.6318591	9.9559689	9.6758902	10.3241097	10.0440311	10.3681409	38
23	9.6321255	9.9559089	9.6762165	10.3237835	10.0440911	10.3678745	37
24	9.6323916	9.9558490	9.6765426	10.3234574	10.0441510	10.3676084	36
25	9.6326576	9.9557890	9.6768686	10.3231314	10.0442110	10.3673424	35
26	9.6329233	9.9557289	9.6771944	10.3228056	10.0442711	10.3670767	34
27	9.6331889	9.9556688	9.6775201	10.3224799	10.0443312	10.3668111	33
28	9.6334542	9.9556087	9.6778456	10.3221544	10.0443913	10.3665458	32
29	9.6337194	9.9555485	9.6781709	10.3218291	10.0444515	10.3662806	31
30	9.6339844	9.9554882	9.6784961	10.3215039	10.0445118	10.3660156	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

64 DEGREES.

Latitude 50 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.35	1	0.36	1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	1	0.43	1	0.44	1	0.45	1	0.46	1	0.47
2	1.10	2	1.12	2	1.14	2	1.16	2	1.18	3	1.21	2	1.23	2	1.25	2	1.27	2	1.29	3	1.32	2	1.34	2	1.36
3	1.48	3	1.51	3	1.54	3	1.57	3	2.00	4	2.04	3	2.07	3	2.10	3	2.13	3	2.16	4	2.20	4	2.24	3	2.27
4	2.30	4	2.34	4	2.38	4	2.42	4	2.46	4	2.50	4	2.54	4	3.58	5	3.03	5	3.08	5	3.13	4	3.17	4	3.21
5	3.16	5	3.21	5	3.26	5	3.31	5	3.36	5	3.41	5	3.46	5	3.51	6	3.57	6	4.03	6	4.09				
6	4.06	6	4.12	6	4.18	6	4.24	6	4.30	6	4.36	6	4.42												
7	5.02	7	5.09	7	5.16																				
WE																									

25 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	4305111	9025853	4769755	20965436	11079285	23228205	30
31	4307736	9024600	4773326	20949751	11080823	23214049	29
32	4310361	9023347	4776899	20934084	11082363	23199911	28
33	4312986	9022093	4780472	20918437	11083903	23185794	27
34	4315610	9020838	4784046	20902809	11085445	23171695	26
35	4318234	9019582	4787621	20887200	11086989	23157615	25
36	4320857	9018325	4791197	20871610	11088533	23143554	24
37	4323480	9017068	4794774	20856039	11090079	23129513	23
38	4326103	9015810	4798352	20840486	11091627	23115490	22
39	4328726	9014551	4801932	20824953	11093176	23101486	21
40	4331348	9013291	4805512	20809438	11094726	23087501	20
41	4333970	9012031	4809093	20793942	11096277	23073535	19
42	4336591	9010770	4812675	20778465	11097830	23059588	18
43	4339212	9009508	4816258	20763007	11099385	23045660	17
44	4341833	9008245	4819842	20747567	11100941	23031751	16
45	4344453	9006982	4823427	20732146	11102498	23017860	15
46	4347073	9005718	4827014	20716743	11104056	23003988	14
47	4349692	9004453	4830601	29701359	11105616	22990134	13
48	4352311	9003187	4834189	20685993	11107177	22976299	12
49	4354930	9001921	4837778	20670646	11108740	22962483	11
50	4357548	9000654	4841368	20655318	11110304	22948685	10
51	4360166	8999386	4844959	20640008	11111869	22934906	9
52	4362784	8998117	4848552	20624716	11113436	22921145	8
53	4365401	8996848	4852145	20609442	11115004	22907403	7
54	4368018	8995578	4855739	20594187	11116573	22893679	6
55	4370634	8994307	4859334	20578950	11118144	22879974	5
56	4373250	8993035	4862931	20563732	11119716	22866286	4
57	4375866	8991762	4866528	20548531	11121290	22852618	3
58	4378482	8990489	4870126	20533349	11122865	22838967	2
59	4381097	8989215	4873726	20518184	11124442	22825334	1
60	4383712	8987940	4877326	20503038	11126019	22811720	0
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co-Secant.	N. Secant.	M

64 DEGREES.

Latitude 51 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.35	1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	1	0.25	1	0.24	1	0.23
2	1.11	2	1.09	2	1.07	2	1.05	2	1.03	2	1.01	2	0.59	2	0.57	2	0.55	[illegible]	[illegible]	2	0.51	3	0.48	1	0.47
3	1.50	3	1.47	3	1.44	3	1.41	3	1.39	3	1.35	3	1.32	3	1.29	3	1.26	3	1.23	[illegible]	[illegible]	4	1.15	3	1.12
4	2.31	4	2.27	4	2.23	4	2.19	4	2.15	4	2.11	4	2.07	4	2.03	4	1.59	4	1.55	5	[illegible]	5	1.45	4	1.41
5	3.17	5	3.12	5	3.07	5	3.02	5	2.57	5	2.52	5	2.47	5	2.42	5	2.37	5	2.32	6	2.26	[illegible]	2.20	5	2.15
6	4.08	5	4.03	6	3.57	6	3.51	6	3.45	6	3.39	6	3.33	6	3.27	6	3.21	7	3.14	7	3.07	7	3.01	6	2.55
7	5.03	6	4.57	6	4.51	6	4.45	7	4.38	7	4.31	7	4.24	7	4.17	7	4.10	7	4.03	7	3.56	7	3.49	6	3.43
WE	6.00	6	5.54	6	5.48	7	5.41	7	5.34	7	5.27	7	5.20	7	5.13	7	5.06	7	4.59	8	4.51	7	4.44	7	4.37
1									6.33	7	6.26	7	6.19	7	6.12	7	6.05	7	5.58	7	5.51	7	5.44	6	5.38
2																	7.07	8	6.59	7	6.52	7	6.45	5	6.40
3																							7.45	1	7.49

25 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.6339844	9.9554882	9.6784961	10.3215039	10.0445118	10.3660156	30
31	9.6342491	9.9554280	9.6788211	10.3211789	10.0445720	10.3657509	29
32	9.6345137	9.9553676	9.6791460	10.3208540	10.0446324	10.3654863	28
33	9.6347780	9.9553073	9.6794708	10.3205292	10.0446927	10.3652220	27
34	9.6350422	9.9552469	9.6797953	10.3202047	10.0447531	10.3649578	26
35	9.6353062	9.9551864	9.6801198	10.3198803	10.0448136	10.3646938	25
36	9.6355699	9.9551259	9.6804440	10.3195560	10.0448741	10.3644301	24
37	9.6358335	9.9550653	9.6807682	10.3192318	10.0449347	10.3641665	23
38	9.6360969	9.9550047	9.6810921	10.3189079	10.0449953	10.3639031	22
39	9.6363601	9.9549441	9.6814160	10.3185840	10.0450559	10.3636399	21
40	9.6366231	9.9548834	9.6817396	10.3182604	10.0451166	10.3633760	20
41	9.6368859	9.9548227	9.6820632	10.3179368	10.0451773	10.3631141	19
42	9.6371484	9.9547619	9.6823865	10.3176135	10.0452381	10.3628516	18
43	9.6374108	9.9547011	9.6827098	10.3172902	10.0452989	10.3625892	17
44	9.6376731	9.9546402	9.6830328	10.3169672	10.0453589	10.3623269	16
45	9.6379351	9.9545793	9.6833557	10.3166443	10.0454207	10.3620649	15
46	9.6381969	9.9545184	9.6836785	10.3163215	10.0454816	10.3618031	14
47	9.6384585	9.9544574	9.6840011	10.3159989	10.0455426	10.3615415	13
48	9.6387199	9.9543963	9.6843236	10.3156764	10.0456037	10.3612801	12
49	9.6389812	9.9543352	9.6846459	10.3153541	10.0456648	10.3610188	11
50	9.6392422	9.9542741	9.6849681	10.3150319	10.0457259	10.3607578	10
51	9.6395030	9.9542129	9.6852901	10.3147099	10.0457871	10.3604970	9
52	9.6397637	9.9541517	9.6856120	10.3143880	10.0458483	10.3602363	8
53	9.6400241	9.9540904	9.6859338	10.3140662	10.0459096	10.3599759	7
54	9.6402844	9.9540291	9.6862553	10.3137447	10.0459709	10.3597156	6
55	9.6405445	9.9539677	9.6865768	10.3134232	10.0460323	10.3594555	5
56	9.6408044	9.9539063	9.6868981	10.3131019	10.0460937	10.3591956	4
57	9.6410640	9.9538448	9.6872192	10.3127808	10.0461552	10.3589360	3
58	9.6413235	9.9537833	9.6875402	10.3124598	10.0462167	10.3586765	2
59	9.6415828	9.9537218	9.6878611	10.3121389	10.0462782	10.3584172	1
60	9.6418420	9.9536602	9.6881818	10.3118182	10.0463398	10.3581580	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

64 DEGREES.

Latitude 51 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.35	1	0.36	1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	1	0.43	1	0.44	2	0.46	1	0.47	1	0.48
2	1.11	2	1.13	2	1.15	2	1.17	2	1.19	2	1.21	3	1.24	2	1.26	2	1.28	2	1.30	2	1.32	2	1.34	2	1.36
3	1.50	3	1.53	3	1.56	3	1.59	3	2.02	3	2.05	4	2.09	3	2.12	3	2.15	3	2.18	3	2.21	3	2.24	3	2.27
4	2.31	4	2.35	4	2.39	4	2.43	4	2.47	5	2.52	5	2.57	4	3.01	4	3.05	4	3.09	4	3.13	5	3.18	3	3.21
5	3.17	5	3.22	5	3.27	5	3.32	5	3.37	5	3.42	7	3.49	5	3.54	5	3.59	5	4.04	5	4.09				
6	4.08	5	4.13	6	4.19	6	4.25	6	4.31	6	4.37	7	4.44												
7	5.03	6	5.09	7	5.16																				
WE																									

26 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N. Co-Secant.	
0	4383712	8987940	4877326	20503038	11126019	22811720	60
1	4386326	8986665	4880927	20487910	11127598	22798124	59
2	4388940	8985389	4884530	20472800	11129179	22784546	58
3	4391553	8984112	4888133	20457708	11130761	22770986	57
4	4394166	8982834	4891737	20442634	11132345	22757445	56
5	4396779	8981555	4895343	20427578	11133930	22743921	55
6	4399392	8980276	4898949	20412540	11135516	22730415	54
7	4402004	8978996	4902557	20397519	11137103	22716927	53
8	4404616	8977715	4906166	20382517	11138692	22703457	52
9	4407227	8976433	4909775	20367532	11140282	22690005	51
10	4409838	8975151	4913386	20352565	11141874	22676571	50
11	4412448	8973868	4916997	20337615	11143467	22663155	49
12	4415058	8972584	4920610	20322683	11145062	22649756	48
13	4417668	8971299	4924224	20307769	11146658	22636375	47
14	4420278	8970013	4927838	20292873	11148255	22623012	46
15	4422887	8968727	4931454	20277994	11149854	22609667	45
16	4425496	8967440	4935071	20263133	11151454	22596339	44
17	4428104	8966152	4938689	20248289	11153056	22583029	43
18	4430712	8964864	4942308	20233462	11154659	22569736	42
19	4433320	8963575	4945928	20218653	11156263	22556461	41
20	4435927	8962285	4949549	20203862	11157869	22543204	40
21	4438534	8960994	4953171	20189088	11159476	22529964	39
22	4441140	8959703	4956794	20174331	11161084	22516741	38
23	4443746	8958411	4960418	20159592	11162694	22503536	37
24	4446352	8957118	4964043	20144869	11164306	22490348	36
25	4448957	8955824	4967669	20130164	11165919	22477178	35
26	4451562	8954529	4971297	20115477	11167533	22464024	34
27	4454167	8953234	4974925	20100806	11169149	22450889	33
28	4456771	8951938	4978554	20086153	11170766	22437770	32
29	4459375	8950641	4982185	20071516	11172384	22424669	31
30	4461978	8949343	4985816	20056897	11174004	22411584	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

63 DEGREES.

Latitude 52 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.35	1	0.35	1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	1	0.25	1	0.24
2	1.12	2	1.10	2	1.08	2	1.06	2	1.04	2	1.03	2	1.01	2	0.59	2	0.57	2	0.55	3	0.52	2	0.50	2	0.48
3	1.51	3	1.48	3	1.45	3	1.42	3	1.39	3	1.36	3	1.33	3	1.30	3	1.27	3	1.23	3	1.21	3	1.18	3	1.15
4	2.33	3	2.30	4	2.26	4	2.22	4	2.18	5	2.13	4	2.09	4	2.05	5	2.00	4	1.56	4	1.52	4	1.48	4	1.44
5	3.19	4	3.15	5	3.10	5	3.05	5	3.00	5	2.55	5	2.50	5	2.45	6	2.39	5	2.34	5	2.29	5	2.24	5	2.19
6	4.09	5	4.04	5	3.59	6	3.53	6	3.47	6	3.41	6	3.35	6	3.29	6	3.23	6	3.17	6	3.11	6	3.05	6	2.59
7	5.03	6	4.57	6	4.51	6	4.45	6	4.39	6	4.33	6	4.27	7	4.20	7	4.13	7	4.06	7	3.59	7	3.52	8	3.46
W E	6.00	6	5.54	6	5.48	7	5.41	7	5.34	6	5.28	7	5.21	7	5.14	7	5.07	7	5.00	7	4.52	6	4.46	6	4.40
1											6.26	6	6.20	6	6.14	7	6.07	7	6.00	7	5.53	7	5.47	7	5.40
2																	7.07	7	7.00	7	6.53	7	6.46	5	6.41
3																							7.45	5	7.40

26 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.6418420	9.9536602	9.6881818	10.3118182	10.0463398	10.3581580	60
1	9.6421009	9.9535985	9.6885023	10.3114977	10.0464015	10.3578991	59
2	9.6423596	9.9535369	9.6888227	10.3111773	10.0464631	10.3576404	58
3	9.6426182	9.9534751	9.6891430	10.3108570	10.0465249	10.3573818	57
4	9.6428765	9.9534134	9.6894631	10.3105369	10.0465866	10.3571235	56
5	9.6431347	9.9533515	9.6897831	10.3102169	10.0466485	10.3568653	55
6	9.6433926	9.9532897	9.6901030	10.3098970	10.0467103	10.3566074	54
7	9.6436504	9.9532278	9.6904226	10.3095774	10.0467722	10.3563496	53
8	9.6439080	9.9531658	9.6907422	10.3092578	10.0468342	10.3560920	52
9	9.6441654	9.9531038	9.6910616	10.3089384	10.0468962	10.3558346	51
10	9.6444226	9.9530418	9.6913809	10.3086191	10.0469582	10.3555774	50
11	9.6446796	9.9529797	9.6917000	10.3083000	10.0470203	10.3553204	49
12	9.6449365	9.9529175	9.6920189	10.3079811	10.0470825	10.3550635	48
13	9.6451931	9.9528553	9.6923378	10.3076622	10.0471447	10.3548069	47
14	9.6454496	9.9527931	9.6926565	10.3073435	10.0472069	10.3545504	46
15	9.6457058	9.9527308	9.6929750	10.3070250	10.0472692	10.3542942	45
16	9.6459619	9.9526685	9.6932934	10.3067066	10.0473315	10.3540381	44
17	9.6462178	9.9526061	9.6936117	10.3063883	10.0473939	10.3537822	43
18	9.6464735	9.9525437	9.6939298	10.3060702	10.0474563	10.3535265	42
19	9.6467290	9.9524813	9.6942478	10.3057522	10.0475187	10.3532710	41
20	9.6469844	9.9524188	9.6945656	10.3054344	10.0475812	10.3530156	40
21	9.6472395	9.9523562	9.6948833	10.3051167	10.0476438	10.3527605	39
22	9.6474945	9.9522936	9.6952009	10.3047991	10.0477064	10.3525055	38
23	9.6477492	9.9522310	9.6955183	10.3044817	10.0477690	10.3522508	37
24	9.6480038	9.9521683	9.6958355	10.3041645	10.0478317	10.3519962	36
25	9.6482582	9.9521055	9.6961527	10.3038473	10.0478945	10.3517418	35
26	9.6485124	9.9520428	9.6964697	10.3035303	10.0479572	10.3514876	34
27	9.6487665	9.9519799	9.6967865	10.3032135	10.0480201	10.3512335	33
28	9.6490203	9.9519171	9.6971032	10.3028968	10.0480829	10.3509797	32
29	9.6492740	9.9518541	9.6974198	10.3025802	10.0481459	10.3507260	31
30	9.6495274	9.9517912	9.6977363	10.3022637	10.0482088	10.3504726	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

63 DEGREES.

Latitude 52 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.36	1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	2	0.43	1	0.44	1	0.45	1	0.46	1	0.47	1	0.48
2	1.12	2	1.14	2	1.16	2	1.18	2	1.20	2	1.22	2	1.24	3	1.27	2	1.29	2	1.31	2	1.33	2	1.35	[illegible]	1.37
3	1.51	3	1.54	3	1.57	3	2.00	3	2.03	3	2.06	3	2.09	4	2.13	3	2.16	3	2.19	3	2.22	3	2.2[illegible]		[illegible]
4	2.33	4	2.37	4	2.41	4	2.45	4	2.49	4	2.53	4	2.57	4	3.01	4	3.05	4	3.09	4	3.13	5	3.1[illegible]		[illegible]
5	3.19	4	3.23	5	3.28	5	3.33	5	3.38	5	3.43	5	3.48	6	3.54	5	3.59	6	4.05	5	4.10	5	4.1[illegible]		
6	4.09	5	4.14	5	4.19	6	4.25	6	4.31	6	4.37	6	4.43	6	4.49	6	4.55								
7	5.03	7	5.10	7	5.17	7	5.24																		

26 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N. Co-Secant.	
30	4461978	8949343	4985816	20056897	11174004	22411584	30
31	4464581	8948045	4989449	20042295	11175625	22398517	29
32	4467184	8946746	4993082	20027710	11177248	22385467	28
33	4469786	8945446	4996717	20013142	11178872	22372435	27
34	4472388	8944145	5000352	19998590	11180498	22359419	26
35	4474990	8942844	5003989	19984056	11182125	22346420	25
36	4477591	8941542	5007627	19969539	11183753	22333438	24
37	4480192	8940239	5011266	19955038	11185383	22320474	23
38	4482792	8938936	5014906	19940554	11187014	22307526	22
39	4485392	8937632	5018547	19926087	11188647	22294595	21
40	4487992	8936327	5022189	19911637	11190281	22281681	20
41	4490591	8935021	5025832	19897204	11191916	22268783	19
42	4493190	8933714	5029476	19882787	11193553	22255903	18
43	4495789	8932406	5033121	19868387	11195191	22243039	17
44	4498387	8931098	5036767	19854003	11196831	22230192	16
45	4500985	8929789	5040415	19839636	11198472	22217362	15
46	4503582	8928479	5044063	19825286	11200115	22204548	14
47	4506179	8927169	5047713	19810952	11201759	22191751	13
48	4508776	8925858	5051363	19796635	[illegible]3405	22178971	12
49	4511372	8924546	5055015	19782334	[illegible]2	22166207	11
50	4513968	8923233	5058668	19768050	[illegible]	[illegible]	10
51	4516563	8921920	5062322	19753782	[illegible]	[illegible]	[illegible]
52	4519158	8920606	5065977	19739531	[illegible]	[illegible]	8
53	4521753	8919291	5069633	19725296	1121[illegible]	[illegible]518	7
54	4524347	8917975	5073290	19711077	1121[illegible]	22102637	6
55	4526941	8916659	5076948	19696874	1121496[illegible]	22089972	5
56	4529535	8915342	5080607	19682688	11216620	22077323	4
57	4532128	8914024	5084267	19668518	11218278	22064691	3
58	4534721	8912705	5087928	19654364	11219938	22052075	2
59	4537313	8911385	5091591	19640227	11221600	22039476	1
60	4539905	8910065	5095254	19626105	11223262	22026893	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

63 DEGREES.

Latitude 53 Deg. 00 Min. *North Declination.*

'	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.36	1	0.35	1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	1	0.25	1	0.24
2	1.13	2	1.11	2	1.09	2	1.07	2	1.03	2	1.03	2	1.01	2	0.59	2	0.57	2	0.55	2	0.53	2	0.51	2	0.49
3	1.52	2	1.50	3	1.47	3	1.44	3	1.41	3	1.38	3	1.35	3	1.32	3	1.29	3	1.26	3	1.23	4	1.19	3	1.16
4	2.34	3	2.31	4	2.27	4	2.23	4	2.19	4	2.15	4	2.11	4	2.07	4	2.03	4	1.59	4	1.55	4	1.51	4	1.47
5	3.20	4	3.16	4	3.12	5	3.07	5	3.02	5	2.57	5	2.52	5	2.47	5	2.42	5	2.37	5	2.32	6	2.26	4	2.22
6	4.10	5	4.05	5	4.00	5	3.55	6	3.49	6	3.43	5	3.38	6	3.32	6	3.26	6	3.20	6	3.14	6	3.09	5	3.03
7	5.04	6	4.58	6	4.52	6	4.46	6	4.40	6	4.34	6	4.28	6	4.22	6	4.16	7	4.09	7	4.02	7	3.55	5	3.50
W E	6.00	6	5.54	6	5.48	6	5.42	6	5.36	7	5.29	6	5.23	6	5.17	7	5.10	7	5.03	7	4.56	7	4.49	6	4.43
1									6.33	7	5.26	6	6.20	6	6.14	6	6.08	7	6.01	7	5.54	7	5.47	5	5.42
2																	7.07	7	7.00	7	6.53	6	6.47	5	6.42
3																					7.51	5	7.46	3	7.43

26 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.6495274	9.9517912	9.6977363	10.3022637	10.0482088	10.3504726	30
31	9.6497807	9.9517282	9.6980526	10.3019474	10.0482718	10.3502193	28
32	9.6500338	9.9516651	9.6983687	10.3016313	10.0483349	10.3499662	29
33	9.6502868	9.9516020	9.6986847	10.3013153	10.0483980	10.3497132	27
34	9.6505395	9.9515389	9.6990006	10.3009994	10.0484611	10.3494605	26
35	9.6507920	9.9514757	9.6993164	10.3006836	10.0485243	10.3492080	25
36	9.6510444	9.9514124	9.6996320	10.3003680	10.0485876	10.3489556	24
37	9.6512966	9.9513492	9.6999474	10.3000526	10.0486508	10.3487034	23
38	9.6515486	9.9512858	9.7002628	10.2997372	10.0487142	10.3484514	22
39	9.6518004	9.9512224	9.7005780	10.2994220	10.0487776	10.3481996	21
40	9.6520521	9.9511590	9.7008930	10.2991070	10.0488410	10.3479479	20
41	9.6523035	9.9510956	9.7012080	10.2987920	10.0489044	10.3476965	19
42	9.6525548	9.9510320	9.7015227	10.2984773	10.0489680	10.3474452	18
43	9.6528059	9.9509685	9.7018374	10.2981626	10.0490315	10.3471941	17
44	9.6530568	9.9509049	9.7021519	10.2978481	10.0490951	10.3469432	16
45	9.6533075	9.9508412	9.7024663	10.2975337	10.0491588	10.3466925	15
46	9.6535581	9.9507775	9.7027805	10.2972195	10.0492225	10.3464419	14
47	9.6538084	9.9507138	9.7030946	10.2969054	10.0492862	10.3461916	13
48	9.6540586	9.9506500	9.7034086	10.2965914	10.0493500	10.3459414	12
49	9.6543086	9.9505861	9.7037225	10.2962775	10.0494139	10.3456914	11
50	9.6545584	9.9505223	9.7040362	10.2959638	10.0494777	10.3454416	10
51	9.6548081	9.9504583	9.7043497	10.2956503	10.0495417	10.3451919	9
52	9.6550575	9.9503944	9.7046632	10.2953368	10.0496056	10.3449425	8
53	9.6553068	9.9503303	9.7049765	10.2950235	10.0496697	10.3446932	7
54	9.6555559	9.9502663	9.7052897	10.2947103	10.0497337	10.3444441	6
55	9.6558048	9.9502022	9.7056027	10.2943973	10.0497978	10.3441952	5
56	9.6560536	9.9501380	9.7059156	10.2940844	10.0498620	10.3439404	4
57	9.6563021	9.9500738	9.7062284	10.2937716	10.0499262	10.3436979	3
58	9.6565505	9.9500095	9.7065410	10.2934590	10.0499905	10.3434495	2
59	9.6567987	9.9499452	9.7068535	10.2931465	10.0500548	10.3432013	1
60	9.6570468	9.9498809	9.7071659	10.2928341	10.0501191	10.3429532	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

63 DEGREES.

Latitude 53 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.36	1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	1	0.43	1	0.44	1	0.45	1	0.46	1	0.47	1	0.48
2	1.13	2	1.15	2	1.17	2	1.19	2	1.21	2	1.23	2	1.25	2	1.27	2	1.29	2	1.31	2	1.33	2	1.35	2	1.37
3	1.52	3	1.55	3	1.58	3	2.01	3	2.04	3	2.07	3	2.10	3	2.13	3	2.16	3	2.19	3	2.22	3	2.25	3	2.28
4	2.34	4	2.38	4	2.42	4	2.46	4	2.50	4	2.54	4	2.58	4	3.02	4	3.06	4	3.10	4	3.14	4	3.18	4	3.22
5	3.20	4	3.24	5	3.29	5	3.34	5	3.39	5	3.41	5	3.49	5	3.54	5	3.59	5	4.04						
6	4.10	5	4.15	5	4.20	5	4.25	6	4.31	6	4.37	6	4.43												
7	5.04	5	5.09	6	5.15																				

27 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant	
0	4539905	8910065	5095254	19626105	11223262	22026893	60
1	4542497	8908744	5098919	19612000	11224926	22014326	59
2	4545088	8907422	5102585	19597910	11226592	22001775	58
3	4547679	8906100	5106252	19583837	11228259	21989240	57
4	4550269	8904777	5109919	19569780	11229928	21976721	56
5	4552859	8903453	5113588	19555739	11231598	21964219	55
6	4555449	8902128	5117259	19541713	11233269	21951733	54
7	4558038	8900802	5120930	19527704	11234942	21939262	53
8	4560627	8899476	5124602	19513711	11236616	21926808	52
9	4563216	8898149	5128275	19499733	11238292	21914370	51
10	4565804	8896821	5131950	19485771	11239969	21901947	50
11	4568392	8895493	5135625	19471826	11241648	21889541	49
12	4570979	8894164	5139302	19457896	11243328	21877150	48
13	4573566	8892834	5142980	19443981	11245010	21864775	47
14	4576153	8891503	5146658	19430083	11246693	21852417	46
15	4578739	8890171	5150338	19416200	11248377	21840074	45
16	4581325	8888839	5154019	19402333	11250063	21827746	44
17	4583910	8887506	5157702	19388481	11251750	21815435	43
18	4586495	8886172	5161385	19374645	11253439	21803139	42
19	4589080	8884837	5165069	19360825	11255129	21790859	41
20	4591664	8883502	5168755	19347020	11256821	21778594	40
21	4594248	8882166	5172441	19333231	11258514	21766345	39
22	4596832	8880829	5176129	19319457	11260209	21754112	38
23	4599415	8879492	5179818	19305698	11261905	21741895	37
24	4601998	8878154	5183508	19291956	11263603	21729693	36
25	4604580	8876815	5187199	19278228	11265302	21717506	35
26	4607162	8875475	5190891	19264516	11267003	21705335	34
27	4609744	8874134	5194584	19250819	11268705	21693180	33
28	4612325	8872793	5198278	19237138	11270408	21681040	32
29	4614906	8871451	5201974	19223472	11272113	21668915	31
30	4617486	8870108	5205670	19209821	11273819	21656806	30
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N. Tangent	N.Co Secant.	N. Secant.	M

62 DEGREES.

Latitude 54 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d	6	d.	8	d	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d	23½
	h. m	n.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.37	1	0.36	1	0.35	1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26	1	0.25
2	1.14	1	1.13	2	1.11	2	1.09	2	1.07	2	1.05	2	1.03	2	1.01	2	0.59	2	0.57	2	0.55	2	0.53	2	0.51
3	1.54	2	1.52	3	1.49	3	1.46	3	1.43	3	1.40	3	1.37	3	1.34	3	1.31	3	1.28	3	1.25	3	1.22	3	1.19
4	2.36	3	2.33	4	2.29	4	2.25	4	2.21	4	2.17	4	2.13	4	2.09	4	2.05	4	2.01	4	1.57	4	1.53	3	1.50
5	3.22	4	3.18	4	3.14	5	3.09	5	3.04	5	2.59	4	2.55	5	2.50	5	2.45	5	2.40	5	2.35	6	2.29	4	2.25
6	4.12	5	4.07	5	4.02	5	3.57	6	3.51	6	3.45	5	3.40	5	3.35	6	3.29	6	3.23	6	3.17	6	3.11	5	3.06
7	5.05	5	5.00	6	4.54	6	4.48	6	4.42	6	4.36	6	4.30	6	4.24	6	4.18	6	4.12	7	4.05	7	3.58	5	3.53
WE	6.00	5	5.55	6	5.49	6	5.43	6	5.37	6	5.31	6	5.25	6	5.19	6	5.13	7	5.06	7	4.59	7	4.52	6	4.46
1									6.33	6	6.27	6	6.21	6	6.15	6	6.09	6	6.03	7	5.56	7	5.49	5	5.44
2															7.10	5	7.05	5	7.00	6	6.54	6	6.48	5	6.43
3																					7.51	5	7.46	4	7.42

27 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.6570468	9.9498809	9.7071659	10.2928341	10.0501191	10.3429532	60
1	9.6572946	9.9498165	9.7074781	10.2925219	10.0501835	10.3427054	59
2	9.6575423	9.9497521	9.7077902	10.2922098	10.0502479	10.3424577	58
3	9.6577898	9.9496876	9.7081022	10.2918978	10.0503124	10.3422102	57
4	9.6580371	9.9496230	9.7084141	10.2915859	10.0503770	10.3419629	56
5	9.6582842	9.9495585	9.7087258	10.2912742	10.0504415	10.3417158	55
6	9.6585312	9.9494938	9.7090374	10.2909626	10.0505062	10.3414688	54
7	9.6587780	9.9494292	9.7093488	10.2906512	10.0505708	10.3412220	53
8	9.6590246	9.9493645	9.7096601	10.2903399	10.0506355	10.3409754	52
9	9.6592710	9.9492997	9.7099713	10.2900287	10.0507003	10.3407290	51
10	9.6595173	9.9492349	9.7102824	10.2897176	10.0507651	10.3404827	50
11	9.6597634	9.9491700	9.7105933	10.2894067	10.0508300	10.3402367	49
12	9.6500093	9.9491051	9.7109041	10.2890959	10.0508949	10.3399907	48
13	9.6602550	9.9490402	9.7112148	10.2887852	10.0509598	10.3397450	47
14	9.6605005	9.9489752	9.7115254	10.2884746	10.0510248	10.3394995	46
15	9.6607459	9.9489101	9.7118358	10.2881642	10.0510899	10.3392541	45
16	9.6609911	9.9488450	9.7121461	10.2878539	10.0511500	10.3390089	44
17	9.6612361	9.9487799	9.7124562	10.2875438	10.0512201	10.3387639	43
18	9.6614810	9.9487147	9.7127662	10.2872338	10.0512853	10.3385190	42
19	9.6617257	9.9486495	9.7130761	10.2869239	10.0513505	10.3382743	41
20	9.6619701	9.9485842	9.7133859	10.2866141	10.0514158	10.3380298	40
21	9.6622145	9.9485189	9.7136956	10.2863044	10.0514811	10.3377855	39
22	9.6624586	9.9484535	9.7140051	10.2859949	10.0515465	10.3375414	38
23	9.6627026	9.9483881	9.7143145	10.2856855	10.0516119	10.3372974	37
24	9.6629464	9.9483227	9.7146237	10.2853763	10.0516773	10.3370536	36
25	9.6631900	9.9482572	9.7149329	10.2850671	10.0517428	10.3368100	35
26	9.6634335	9.9481916	9.7152419	10.2847581	10.0518084	10.3365665	34
27	9.6636768	9.9481260	9.7155508	10.2844492	10.0518740	10.3363232	33
28	9.6639199	9.9480604	9.7158595	10.2841405	10.0519396	10.3360801	32
29	9.6641628	9.9479947	9.7161682	10.2838318	10.0520053	10.3358372	31
30	9.6644056	9.9479289	9.7164767	10.2835233	10.0520711	10.3355944	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

62 DEGREES.

Latitude 54 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.37	0	0.37	1	0.38	1	0.39	1	0.44	1	0.41	1	0.42	1	0.43	1	0.44	1	0.45	1	0.46	1	0.47	1	0.48
2	1.14	1	1.15	2	1.19	2	1.19	2	1.21	2	1.23	2	1.25	2	1.27	2	1.29	2	1.31	2	1.33	2	1.35	2	1.37
3	1.54	2	1.56	3	1.59	3	2.02	3	2.05	3	2.08	3	2.11	3	2.14	3	2.17	3	2.20	3	[illegible]	3	2.26	2	2.28
4	2.36	3	2.39	4	2.43	4	2.47	4	2.51	4	2.55	4	2.59	4	3.03	4	3.07	4	3.11	[illegible]	[illegible]	[illegible]	3.19	3	3.22
5	3.22	4	3.26	4	3.30	4	3.34	5	3.39	5	3.44	5	3.49	5	3.54	5	3.59								
6	4.12	5	4.17	5	4.22	5	4.27	5	4.32	6	4.38	6	4.44												
7	5.05	6	5.11	6	5.17																				
WE																									

27 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	4617486	8870108	5205670	19209821	11273819	21656806	30
31	4620066	8868764	5209368	19196186	11275527	21644712	29
32	4622646	8867420	5213067	19182565	11277237	21632633	28
33	4625225	8866075	5216767	19168960	11278948	21620570	27
34	4627804	8864729	5220468	19155370	11280660	21608522	26
35	4630382	8863383	5224170	19141795	11282374	21596489	25
36	4632960	8862036	5227874	19128236	11284089	21584471	24
37	4635538	8860688	5231578	19114691	11285806	21572469	23
38	4638115	8859339	5235284	19101162	11287524	21560482	22
39	4640692	8857989	5238990	19087647	11289244	21548510	21
40	4643269	8856639	5242698	19074147	11290965	21536553	20
41	4645845	8855288	5246407	19060663	11292688	21524611	19
42	4648421	8853936	5250117	19047193	11294412	21512684	18
43	4650996	8852583	5253829	19033738	11296137	21500772	17
44	4653571	8851230	5257541	19020299	11297864	21488875	16
45	4656145	8849876	5261254	19006874	11299593	21476993	15
46	4658719	8848521	5264969	18993464	11301323	21465127	14
47	4661293	8847166	5268685	18980068	11303055	21453275	13
48	4663866	8845810	5272402	18966688	11304788	21441437	12
49	4666439	8844453	5276120	18953322	11306522	21429615	11
50	4669012	8843095	5279839	18939971	11308258	21417808	10
51	4671584	8841736	5283559	18926634	11309996	21406015	9
52	4674156	8840377	5287281	18913313	11311735	21394238	8
53	4676727	8839017	5291004	18900006	11313475	21382475	7
54	4679298	8837656	5294727	18886713	11315217	21370726	6
55	4681869	8836294	5298452	18873436	11316961	21358993	5
56	4684439	8834932	5302178	18860172	11318706	21347274	4
57	4687009	8833569	5305906	18846924	11320452	21335570	3
58	4689578	8832205	5309634	18833690	11322200	21323880	2
59	4692147	8830841	5313364	18820470	11323950	21312205	1
60	4694716	8829476	5317094	18807265	11325701	21300545	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co Secant.	N. Secant.	M

62 DEGREES.

Latitude 55 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d	6	d.	8	d	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.37	0	0.37	1	0.36	1	0.35	1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26
2	1.15	1	1.14	2	1.12	2	1.10	2	1.15	2	1.06	2	1.04	2	1.02	2	1.00	2	0.58	2	0.56	2	0.54	2	0.52
3	1.55	2	1.53	3	1.50	3	1.47	3	1.44	3	1.41	2	1.39	3	1.36	3	1.33	3	1.30	3	1.27	4	1.23	2	1.21
4	2.37	3	2.34	3	2.31	4	2.27	4	2.23	4	2.19	3	2.16	4	2.12	4	2.08	4	2.04	4	2.00	5	1.55	3	1.52
5	3.22	4	3.19	4	3.15	4	3.11	5	3.06	5	3.01	4	2.57	4	2.53	5	2.48	5	2.43	5	2.38	5	2.33	4	2.29
6	4.13	5	4.08	5	4.03	5	3.58	5	3.53	6	3.47	5	3.42	5	3.37	5	3.32	6	3.26	6	3.20	6	3.14	4	3.10
7	5.06	5	5.01	5	4.56	6	4.50	6	4.44	6	4.38	6	4.32	6	4.26	6	4.20	6	4.14	6	4.08	6	4.02	6	3.56
WE	6.00	5	5.55	5	5.50	6	5.44	6	5.38	6	5.32	6	5.26	6	5.20	6	5.14	6	5.08	7	5.01	7	4.54	5	4.49
1											6.27	6	6.21	6	6.15	6	6.09	6	6.03	6	5.57	6	5.51	5	5.46
2															7.09	5	7.04	5	6.59	5	6.54	5	6.49	5	6.44
3																					7.51	5	7.46	4	7.42

27 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.6644056	9.9479289	9.7164767	10.2835233	10.0520711	10.3355944	30
31	9.6646482	9.9478631	9.7167851	10.2832149	10.0521369	10.3353518	29
32	9.6648906	9.9477973	9.7170933	10.2829067	10.0522027	10.3351094	28
33	9.6651329	9.9477314	9.7174014	10.2825986	10.0522686	10.3348671	27
34	9.6653749	9.9476655	9.7177094	10.2822906	10.0523345	10.3346251	26
35	9.6656168	9.9475995	9.7180173	10.2819827	10.0524005	10.3343832	25
36	9.6658586	9.9475335	9.7183251	10.2816749	10.0524665	10.3341414	24
37	9.6661001	9.9474674	9.7186327	10.2813673	10.0525326	10.3338999	23
38	9.6663415	9.9474013	9.7189402	10.2810598	10.0525987	10.3336585	22
39	9.6665828	9.9473352	9.7192476	10.2807524	10.0526648	10.3334172	21
40	9.6668238	9.9472689	9.7195549	10.2804451	10.0527311	10.3331762	20
41	9.6670647	9.9472027	9.7198620	10.2801380	10.0527973	10.3329353	19
42	9.6673054	9.9471364	9.7201690	10.2798310	10.0528636	10.3326946	18
43	9.6675459	9.9470700	9.7204759	10.2795241	10.0529300	10.3324541	17
44	9.6677863	9.9470036	9.7207827	10.2792173	10.0529964	10.3322137	16
45	9.6680265	9.9469372	9.7210893	10.2789107	10.0530628	10.3319735	15
46	9.6682665	9.9468707	9.7213958	10.2786042	10.0531293	10.3317335	14
47	9.6685064	9.9468042	9.7217022	10.2782978	10.0531958	10.3314936	13
48	9.6687461	9.9467376	9.7220085	10.2779915	10.0532624	10.3312539	12
49	9.6689855	9.9466710	9.7223147	[illegible]	10.0533290	10.3310144	11
50	9.6692250	[illegible]	[illegible]	[illegible]	10.0533957	10.3307750	10
51	9.6694642	9.9465376	[illegible]	[illegible]	10.0534624	10.3305358	9
52	9.6697032	9.9464708	[illegible]	[illegible]	10.0535292	10.3302968	8
53	9.6699420	9.9464040	9.7235381	[illegible]	10.0535960	10.3300580	7
54	9.6701807	9.9463371	9.7238436	[illegible]	10.0536629	10.3298193	6
55	9.6704192	9.9462702	9.7241490	10.2758510	10.0537298	10.3295808	5
56	9.6706576	9.9462032	9.7244543	10.2755457	10.0537968	10.3293424	4
57	9.6708958	9.9461362	9.7247595	10.2752405	10.0538638	10.3291042	3
58	9.6711338	9.9460692	9.7250646	10.2749354	10.0539308	10.3288662	2
59	9.6713716	9.9460021	9.7253695	10.2746305	10.0539979	10.3286284	1
60	9.6716093	9.9459349	9.7256744	10.2743256	10.0540651	10.3283907	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

62 DEGREES.

Latitude 55 Deg. 00 Min. South Declination.

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	0	0.42	1	0.43	1	0.44	1	0.45	1	0.46	1	0.47	1	0.48
2	1.15	1	1.16	2	1.18	2	1.20	2	1.22	2	1.24	2	1.26	2	1.28	2	1.30	2	1.32	2	1.34	2	1.36	2	1.38
3	1.55	2	1.57	2	1.59	3	2.02	3	2.05	3	2.08	3	2.11	3	2.14	3	2.17	3	2.20	3	2.23	3	2.26	3	2.29
4	2.37	3	2.40	3	2.43	4	2.47	4	2.51	4	2.55	4	2.59	4	3.03	4	3.07	4	3.11	4	3.15	4	3.19	3	3.22
5	3.23	4	3.27	4	3.31	4	3.35	5	3.40	5	3.45	5	3.50	5	3.55	5	4.00	5	4.05						
6	4.13	5	4.18	5	4.23	5	4.28	5	4.33	5	4.38	6	4.44												
7	5.06	6	5.12	6	5.18	6	5.24																		
WE																									

28 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N. Co-Secant.	
0	4694716	8829476	5317094	18807265	11325701	21300545	60
1	4697284	8828110	5320826	18794074	11327453	21288899	59
2	4699852	8826743	5324559	18780898	11329207	21277267	58
3	4702419	8825375	5328293	18767736	11330962	21265651	57
4	4704986	8824007	5332029	18754588	11332719	21254048	56
5	4707553	8822638	5335765	18741455	11334478	21242460	55
6	4710119	8821268	5339503	18728336	11336238	21230887	54
7	4712685	8819898	5343242	18715231	11337999	21219328	53
8	4715250	8818527	5346982	18702141	11339762	21207783	52
9	4717815	8817155	5350723	18689064	11341527	21196253	51
10	4720380	8815782	5354465	18676003	11343293	21184737	50
11	4722944	8814409	5358208	18662955	11345090	21173235	49
12	4725508	8813035	5361953	18649921	11346829	21161748	48
13	4728071	8811660	5365699	18636902	11348600	21150274	47
14	4730634	8810284	5369446	18623896	11350372	21138815	46
15	4733197	8808907	5373194	18610905	11352146	21127371	45
16	4735759	8807530	5376943	18597928	11353921	21115940	44
17	4738321	8806152	5380694	18584965	11355698	21104523	43
18	4740882	8804773	5384445	18572015	11357476	21093121	42
19	4743443	8803394	5388198	18559080	11359255	21081733	41
20	4746004	8802014	5391952	18546159	11361036	21070359	40
21	4748564	8800633	5395707	18533252	11362819	21058998	39
22	4751124	8799251	5399464	18520358	11364603	21047652	38
23	4753683	8797869	5403221	18507479	11366389	21036320	37
24	4756242	8796486	5406980	18494613	11368176	21025002	36
25	4758801	8795102	5410740	18481761	11369965	21013698	35
26	4761359	8793717	5414501	18468923	11371755	21002408	34
27	4763917	8792332	5418263	18456099	11373547	20991131	33
28	4766474	8790946	5422027	18443289	11375340	20979869	32
29	4769031	8789559	5425791	18430492	11377135	20968620	31
30	4771588	8788171	5429557	18417709	11378932	20957385	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

61 DEGREES.

Latitude 56 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.37	0	0.37	1	0.36	1	0.35	1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27	1	0.26
2	1.16	1	1.15	2	1.13	2	1.11	2	1.09	2	1.07	2	1.05	2	1.03	2	1.01	2	0.59	2	0.57	2	0.55	2	0.53
3	1.56	2	1.54	2	1.52	3	1.49	3	1.46	3	1.43	3	1.40	3	1.37	3	1.34	3	1.31	3	1.28	2	1.26	3	1.23
4	2.39	3	2.36	3	2.33	4	2.29	4	2.25	4	2.21	3	2.18	4	2.14	4	2.10	4	2.06	4	2.02	3	1.59	4	1.55
5	3.25	4	3.21	4	3.17	4	3.13	5	3.08	5	3.03	4	2.59	4	2.55	5	2.50	5	2.45	5	2.40	4	2.36	4	2.32
6	4.14	4	4.10	5	4.05	5	4.00	5	3.55	5	3.30	5	3.45	5	3.40	5	3.35	6	3.29	6	3.23	6	3.17	4	3.13
7	5.06	5	5.01	5	4.56	5	4.51	5	4.46	6	4.40	5	4.35	6	4.29	6	4.23	6	4.17	6	4.11	6	4.05	5	4.00
W E	6.00	5	5.55	5	5.50	6	5.44	6	5.38	6	5.32	5	5.27	6	5.21	6	5.15	6	5.09	6	5.03	6	4.57	5	4.52
1									6.34	6	6.28	5	6.23	6	6.17	6	6.11	6	6.05	6	5.59	6	5.53	5	5.48
2													7.15	5	7.10	5	7.05	5	7.00	5	6.55	5	6.50	5	6.45
3																					7.51		7.46	3	7.43

28 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.6716093	9.9459349	9.7256744	10.2743256	10.0540651	10.3283907	60
1	9.6718468	9.9458677	9.7259791	10.2740209	10.0541323	10.3281532	59
2	9.6720841	9.9458005	9.7262837	10.2737163	10.0541995	10.3279159	58
3	9.6723213	9.9457332	9.7265881	10.2734119	10.0542668	10.3276787	57
4	9.6725583	9.9456659	9.7268925	10.2731075	10.0543341	10.3274417	56
5	9.6727952	9.9455985	9.7271967	10.2728033	10.0544015	10.3272048	55
6	9.6730319	9.9455310	9.7275008	10.2724992	10.0544690	10.3269681	54
7	9.6732684	9.9454036	9.7278048	10.2721952	10.0545364	10.3267316	53
8	9.6735047	9.9453960	9.7281087	10.2718913	10.0546040	10.3264953	52
9	9.6737409	9.9453285	9.7284124	10.2715876	10.0546715	10.3262591	51
10	9.6739769	9.9452609	9.7287161	10.2712839	10.0547391	10.3260231	50
11	9.6742128	9.9451932	9.7290196	10.2709804	10.0548068	10.3257872	49
12	9.6744485	9.9451255	9.7293230	10.2706770	10.0548745	10.3255515	48
13	9.6746840	9.9450577	9.7296263	10.2703737	10.0549423	10.3253160	47
14	9.6749194	9.9449899	9.7299295	10.2700705	10.0550101	10.3250806	46
15	9.6751346	9.9449220	9.7302325	10.2697675	10.0550780	10.3248454	45
16	9.6753896	9.9448541	9.7305354	10.2694646	10.0551459	10.3246104	44
17	9.6756245	9.9447862	9.7308383	10.2691617	10.0552138	10.3243756	43
18	9.6758592	9.9447182	9.7311410	10.2688590	10.0552818	10.3241408	42
19	9.6760937	9.9446501	9.7314436	10.2685564	10.0553499	10.3239063	41
20	9.6763281	9.9445821	9.7317460	10.2682540	10.0554179	10.3236719	40
21	9.6765623	9.9445139	9.7320484	10.2679516	10.0554861	10.3234377	39
22	9.6767963	9.9444457	9.7323506	10.2676494	10.0555543	10.3232037	38
23	9.6770302	9.9443775	9.7326527	10.2673473	10.0556225	10.3229698	37
24	9.6772640	9.9443092	9.7329547	10.2670453	10.0556908	10.3227360	36
25	9.6774975	9.9442409	9.7332566	10.2667434	10.0557591	10.3225025	35
26	9.6777309	9.9441725	9.7335584	10.2664416	10.0558275	10.3222691	34
27	9.6779642	9.9441041	9.7338601	10.2661399	10.0558959	10.3220358	33
28	9.6781972	9.9440356	9.7341616	10.2658384	10.0559644	10.3218028	32
29	9.6784301	9.9439671	9.7344631	10.2655369	10.0560329	10.3215699	31
30	9.6786629	9.9438985	9.7347644	10.2652356	10.0561015	10.3213371	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

61 DEGREES.

Latitude 56 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	1	0.43	1	0.44	1	0.45	1	0.46	1	0.47	1	0.48	1	0.49
2	1.16	1	1.17	2	1.19	2	1.21	2	1.23	2	1.25	1	1.26	2	1.28	2	1.30	2	1.32	2	1.34	2	1.36	2	1.38
3	1.56	2	1.58	2	2.00	3	2.03	3	2.06	3	2.09	2	2.12	3	2.14	3	2.17	3	2.20	3	2.23	3	2.26	3	2.29
4	2.39	3	2.42	3	2.45	4	2.49	4	2.53	4	2.57	3	3.00	3	3.03	4	3.07	4	3.11	4	3.15	4	3.19		
5	3.25	4	3.29	4	3.33	4	3.37	4	3.41	5	3.46	3	3.49	4	3.53	4	3.57								
6	4.14	4	4.18	5	4.23	5	4.28	5	4.33	5	4.38														
7	5.06	5	5.11	5	5.16	5	5.21																		

28 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N. Co-Secant.	
30	4771588	8788171	5429557	18417709	11378932	20957385	30
31	4774144	8786783	5433324	18404939	11380730	20946164	29
32	4779700	8785394	5437092	18392184	11382529	20934957	28
33	4779255	8784004	5440862	18379442	11384330	20923764	27
34	4781810	8782613	5444632	18366713	11386133	20912584	26
35	4784364	8781222	5448404	18353999	11387937	20901418	25
36	4786918	8779830	5452177	18341297	11389743	20890265	24
37	4789472	8778437	5455951	18328610	11391550	20879127	23
38	4792026	8777043	5459726	18315936	11393359	20868002	22
39	4794579	8775649	5463503	18303275	11395169	20856890	21
40	4797131	8774254	5467281	18290628	11396981	20845792	20
41	4799683	8772858	5471060	18277994	11398794	20834708	19
42	4802235	8771461	5474840	18265374	11400609	20823637	18
43	4804786	8770064	5478621	18252767	11402425	20812580	17
44	4807337	8768666	5482404	18240173	11404243	20801536	16
45	4809888	8767267	5486188	18227593	11406062	20790506	15
46	4812438	8765868	5489973	18215026	11407883	20779489	14
47	4814988	8764468	5493759	18202473	11409706	20768486	13
48	4817537	8763067	5497546	18189932	11411530	20757496	12
49	4820086	8761665	5501335	18177405	11413356	20746519	11
50	4822634	8760262	5505125	18164892	11415183	20735556	10
51	4825182	8758859	5508916	18152391	11417012	20724606	9
52	4827730	8757455	5512708	18139904	11418842	20713670	8
53	4830277	8756050	5516502	18127430	11420674	20702746	7
54	4832824	8754645	5520297	18114969	11422507	20691836	6
55	4835370	8753239	5524093	18102521	11424342	20680940	5
56	4837916	8751832	5527890	18090086	11426179	20670056	4
57	4840462	8750424	5531688	18077664	11428017	20659186	3
58	4843007	8749016	5535488	18065256	11429857	20648328	2
59	4845552	8747607	5539288	18052860	11431698	20637484	1
60	4848096	8746197	5543090	18040478	11433541	20626653	0
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N. Tangent	N.Co.Secant.	N. Secant.	M

61 DEGREES.

Latitude 57 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d	6	d.	8	d	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	n.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.38	0	0.38	1	0.37	1	0.36	1	0.35	1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28	1	0.27
2	1.17	1	1.16	2	1.14	2	1.12	2	1.10	2	1.08	1	1.07	2	1.05	2	1.03	2	1.01	2	0.59	2	0.57	2	0.55
3	1.57	2	1.55	2	1.53	3	1.50	3	1.47	3	1.44	2	1.42	3	1.39	3	1.36	3	1.33	3	1.30	3	1.27	2	1.25
4	2.40	3	2.37	3	2.34	3	2.31	4	2.27	4	2.23	3	2.20	3	2.17	4	2.13	4	2.09	4	2.05	4	2.01	3	1.58
5	3.26	4	3.22	4	3.18	4	3.14	4	3.10	5	3.05	4	3.01	4	2.57	4	2.53	5	2.48	5	2.43	5	2.38	3	2.35
6	4.15	4	4.11	5	4.06	5	4.01	5	3.56	5	3.51	5	3.46	5	3.41	5	3.36	5	3.31	5	3.26	6	3.20	4	3.16
7	5.07	5	5.02	5	4.57	5	4.52	5	4.47	6	4.41	5	4.36	5	4.31	6	4.25	6	4.19	6	4.13	6	4.07	4	4.03
WE	6.00	5	5.55	5	5.50	5	5.45	6	5.39	6	5.33	5	5.28	5	5.23	6	5.17	6	5.11	6	5.05	6	4.59	5	4.54
1											6.28	5	6.23	5	6.18	6	6.12	6	6.06	6	6.00	6	5.54	4	5.50
2															7.11	5	7.06	5	7.01	5	6.56	5	6.51	5	6.46
3																					7.52	5	7.47	4	7.43
4																									8.30

28 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.6786629	9.9438985	9.7347644	10.2652356	10.0561015	10.3213371	30
31	9.6788955	9.9438299	9.7350656	10.2649344	10.0561701	10.3211045	29
32	9.6791279	9.9437612	9.7353667	10.2646333	10.0562388	10.3208721	28
33	9.6793602	9.9436925	9.7356677	10.2643323	10.0563075	10.3206398	27
34	9.6795923	9.9436238	9.7359685	10.2640315	10.0563762	10.3204077	26
35	9.6798243	9.9435549	9.7362693	10.2637307	10.0564451	10.3201757	25
36	9.6800560	9.9434861	9.7365699	10.2634301	10.0565139	10.3199440	24
37	9.6802877	9.9434172	9.7368705	10.2631295	10.0565828	10.3197123	23
38	9.6805191	9.9433482	9.7371709	10.2628291	10.0566518	10.3194809	22
39	9.6807504	9.9432792	9.7374712	10.2625288	10.0567208	10.3192496	21
40	9.6809816	9.9432102	9.7377714	10.2622286	10.0567898	10.3190184	20
41	9.6812126	9.9431411	9.7380715	10.2619285	10.0568589	10.3187874	19
42	9.6814434	9.9430720	9.7383714	10.2616286	10.0569280	10.3185565	18
43	9.6816741	9.9430028	9.7386713	10.2613287	10.0569972	10.3183259	17
44	9.6819046	9.9429335	9.7389710	10.2610290	10.0570665	10.3180954	16
45	9.6821349	9.9428643	9.7392707	10.2607293	10.0571357	10.3178651	15
46	9.6823651	9.9427949	9.7395702	10.2604298	10.0572051	10.3176349	14
47	9.6825952	9.9427255	9.7398696	10.2601304	10.0572745	10.3174048	13
48	9.6828250	9.9426561	9.7401689	10.2598311	10.0573439	10.3171750	12
49	9.6830548	9.9425866	9.7404681	10.2595319	10.0574134	10.3169452	11
50	9.6832843	9.9425171	9.7407672	10.2592328	10.0574829	10.3167157	10
51	9.6835137	9.9424476	9.7410662	10.2589338	10.0575524	10.3164863	9
52	9.6837430	9.9423779	9.7413650	10.2586350	10.0576221	10.3162570	8
53	9.6839720	9.9423083	9.7416638	10.2583362	10.0576917	10.3160280	7
54	9.6842010	9.9422386	9.7419624	10.2580376	10.0577614	10.3157990	6
55	9.6844297	9.9421688	9.7422609	10.2577391	10.0578312	10.3155703	5
56	9.6846583	9.9420990	9.7425594	10.2574406	10.0579010	10.3153417	4
57	9.6848868	9.9420291	9.7428577	10.2571423	10.0579709	10.3151132	3
58	9.6851151	9.9419592	9.7431559	10.2568441	10.0580408	10.3148849	2
59	9.6853432	9.9418893	9.7434540	10.2565460	10.0581107	10.3146568	1
60	9.6855712	9.9418193	9.7437520	10.2562480	10.0581807	10.3144288	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

61 DEGREES.

Latitude 57 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m	m.	h. m.	m.	h. m	m.	h. m	m.	h. m.	m.	h. m	m.	h. m	m	h. m.
SN	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.37	1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	1	0.43	1	0.44	1	0.45	1	0.46	1	0.47	1	0.48	1	0.49
2	1.17	1	1.18	1	1.19	2	1.21	2	1.23	2	1.25	1	1.26	2	1.28	2	1.30	2	1.32	2	1.34	2	1.36	2	1.38
3	1.57	2	1.59	2	2.01	3	2.04	3	2.07	3	2.10	2	2.12	3	2.15	3	2.18	3	2.21	3	2.24	3	2.27	2	2.29
4	2.40	3	2.43	3	2.46	3	2.49	4	2.53	4	2.57	3	3.00	3	3.03	4	3.07	4	3.11	4	3.15	4	3.19		
5	3.26	4	3.30	4	3.34	4	3.38	4	3.42	4	3.46	4	3.50	4	3.54	5	3.59								
6	4.15	4	4.19	4	4.23	5	4.28	5	4.33	5	4.38														
7	5.07	5	5.12	5	5.17	6	5.23																		

29 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N. Co-Secant.	
0	4848096	8746197	5543091	18040478	11433541	20626653	60
1	4850640	8744786	5546894	18028108	11435385	20615836	59
2	4853184	8743375	5550698	18015751	11437231	20605031	58
3	4855727	8741963	5554504	18003408	11439078	20594239	57
4	4858270	8740550	5558311	17991077	11440927	20583460	56
5	4860812	8739136	5562119	17978759	11442778	20572695	55
6	4863354	8737722	5565929	17966454	11444630	20561942	54
7	4865895	8736307	5569739	17954162	11446484	20551203	53
8	4868436	8734891	5573551	17941883	11448339	20540476	52
9	4870977	8733475	5577364	17929616	11450196	20529762	51
10	4873517	8732058	5581179	17917362	11452055	20519061	50
11	4876057	8730640	5584994	17905121	11453915	20508373	49
12	4878597	8729221	5588811	17892893	11455776	20497698	48
13	4881136	8727801	5592629	17880678	11457639	20487036	47
14	4883674	8726381	5596448	17868475	11459504	20476386	46
15	4886212	8724960	5600269	17856285	11461370	20465750	45
16	4888750	8723538	5604091	17844107	11463238	20455126	44
17	4891287	8722116	5607914	17831943	11465108	20444515	43
18	4893824	8720693	5611738	17819790	11466979	20433916	42
19	4896361	8719269	5615564	17807651	11468852	20423330	41
20	4898897	8717844	5619391	17795524	11470726	20412757	40
21	4901433	8716419	5623219	17783409	11472602	20402197	39
22	4903968	8714993	5627048	17771307	11474479	20391649	38
23	4906503	8713566	5630879	17759218	11476358	20381114	37
24	4909037	8712138	5634710	17747141	11478239	20370592	36
25	4911571	8710710	5638543	17735076	11480121	20360082	35
26	4914105	8709281	5642378	17723024	11482005	20349585	34
27	4916638	8707851	5646213	17710985	11483890	20339100	33
28	4919171	8706420	5650050	17698958	11485777	20328627	32
29	4921704	8704989	5653888	17686943	11487665	20318168	31
30	4924236	8703557	5657728	17674940	11489555	20307720	30
	N. Co-Sine.	N. Sine.	N. Co-Tang	N. Tangent.	N. Co Secant.	N. Secant.	M

60 DEGREES.

Latitude 58 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.38	0	0.38	1	0.37	1	0.36	1	0.35	1	0.34	0	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	1	0.28
2	1.17	1	1.16	1	1.15	2	1.14	2	1.13	2	1.09	1	1.08	2	1.06	2	1.04	2	1.02	2	1.00	2	0.58	1	0.57
3	1.58	2	1.56	2	1.54	2	1.52	3	1.49	3	1.46	2	1.44	3	1.41	3	1.38	3	1.35	3	1.32	3	1.29	2	1.27
4	2.41	3	2.38	3	2.35	3	2.32	3	2.29	4	2.25	3	2.22	3	2.19	4	2.15	4	2.11	4	2.07	3	2.04	3	2.01
5	3.27	4	3.23	4	3.19	4	3.15	4	3.01	4	3.07	4	3.03	4	2.59	4	2.55	4	2.51	5	2.46	5	2.41	3	2.38
6	4.16	4	4.12	4	4.08	5	4.03	5	3.58	5	3.53	4	3.49	5	3.44	5	3.39	5	3.34	5	3.29	6	3.23	4	3.19
7	5.07	4	5.03	5	4.58	5	4.53	5	4.48	5	4.43	5	4.38	5	4.33	5	4.28	6	4.22	6	4.16	6	4.10	4	4.16
W E	6.00	5	5.55	5	5.50	5	5.45	5	5.40	5	5.35	5	5.30	5	5.25	5	5.20	6	5.14	6	5.08	6	5.02	5	4.57
1									6.34	6	6.28	5	6.23	5	6.15	5	6.13	5	6.08	6	6.02	6	5.56	5	5.51
2													7.19	6	7.13	6	7.07	5	7.02	5	6.57	5	6.52	4	6.48
3																	8.02	5	7.57	5	7.92	5	7.47	3	7.44
4																									8.38

29 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.6855712	9.9418193	9.7437520	10.2562480	10.0581807	10.3144288	60
1	9.6857991	9.9417492	9.7440499	10.2559501	10.0582508	10.3142009	59
2	9.6860267	9.9416791	9.7443476	10.2556524	10.0583209	10.3139733	58
3	9.6862542	9.9416090	9.7446453	10.2553547	10.0583910	10.3137458	57
4	9.6864816	9.9415388	9.7449428	10.2550572	10.0584612	10.3135184	56
5	9.6867088	9.9414685	9.7452403	10.2547597	10.0585315	10.3132912	55
6	9.6869359	9.9413982	9.7455376	10.2544624	10.0586018	10.3130641	54
7	9.6871628	9.9413279	9.7458349	10.2541651	10.0586721	10.3128372	53
8	9.6873895	9.9412575	9.7461320	10.2538680	10.0587425	10.3126105	52
9	9.6876161	9.9411871	9.7464290	10.2535710	10.0588129	10.3123839	51
10	9.6878425	9.9411166	9.7467259	10.2532741	10.0588834	10.3121575	50
11	9.6880688	9.9410461	9.7470227	10.2529773	10.0589539	10.3119312	49
12	9.6882949	9.9409755	9.7473194	10.2526806	10.0590245	10.3117051	48
13	9.6885209	9.9409048	9.7476160	10.2523840	10.0590952	10.3114791	47
14	9.6887467	9.9408342	9.7479125	10.2520875	10.0591658	10.3112533	46
15	9.6889723	9.9407634	9.7482089	10.2517911	10.0592366	10.3110277	45
16	9.6891978	9.9406927	9.7485052	10.2514948	10.0593073	10.3108022	44
17	9.6894232	9.9406219	9.7488013	10.2511987	10.0593781	10.3105768	43
18	9.6896484	9.9405510	9.7490974	10.2509026	10.0594490	10.3103516	42
19	9.6898734	9.9404801	9.7493934	10.2506066	10.0595199	10.3101266	41
20	9.6900983	9.9404091	9.7496892	10.2503108	10.0595909	10.3099017	40
21	9.6903231	9.9403381	9.7499850	10.2500150	10.0596619	10.3096769	39
22	9.6905476	9.9402670	9.7502806	10.2497194	10.0597330	10.3094524	38
23	9.6907721	9.9401959	9.7505762	10.2494238	10.0598041	10.3092279	37
24	9.6909964	9.9401248	9.7508716	10.2491284	10.0598752	10.3090036	36
25	9.6912205	9.9400535	9.7511669	10.2488331	10.0599465	10.3087795	35
26	9.6914445	9.9399823	9.7514622	10.2485378	10.0600177	10.3085555	34
27	9.6916683	9.9399110	9.7517573	10.2482427	10.0600890	10.3083317	33
28	9.6918919	9.9398396	9.7520523	10.2479477	10.0601604	10.3081081	32
29	9.6921155	9.9397682	9.7523472	10.2476528	10.0602318	10.3078845	31
30	9.6923388	9.9396968	9.7526420	10.2473580	10.0603032	10.3076612	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

60 DEGREES.

Latitude 58 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.38	1	0.39	1	0.40	1	0.41	1	0.42	1	0.43	0	0.43	1	0.44	1	0.45	1	0.46	1	0.47	1	0.48	1	0.49
2	1.17	1	1.18	2	1.20	2	1.22	2	1.24	2	1.26	1	1.27	2	1.29	2	1.31	2	1.33	2	1.35	2	1.37	1	1.38
3	1.58	2	2.00	2	2.02	2	2.04	3	2.07	3	2.10	2	2.12	3	2.15	3	2.18	3	2.21	3	2.24	3	2.27	2	2.29
4	2.41	3	2.44	3	2.47	3	2.50	3	2.53	4	2.57	3	3.00	3	3.03	4	3.07	4	3.11	4	3.15	4	3.19		
5	3.27	4	3.31	4	3.35	4	3.39	4	3.43	4	3.47	3	3.50	4	3.54	4	3.58								
6	4.16	4	4.20	4	4.24	4	4.28	5	4.33	5	4.38														
7	5.07	4	5.11	5	5.16	5	5.21																		

29 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	4924236	8703557	5657728	17674940	11489555	20307720	30
31	4926767	8702124	5661568	17662950	11491447	20297286	29
32	4929298	8700690	5665410	17650972	11493340	20286863	28
33	4931829	8699256	5669253	17639007	11495235	20276453	27
34	4934359	8697821	5673098	17627053	11497132	20266056	26
35	4936889	8696385	5676944	17615112	11499030	20255670	25
36	4939419	8694949	5680791	17603183	11500930	20245297	24
37	4941948	8693512	5684639	17591267	11502831	20234937	23
38	4944477	8692074	5688488	17579362	11504734	20224589	22
39	4947005	8690635	5692339	17567470	11506638	20214253	21
40	4949533	8689196	5696191	17555590	11508544	20203929	20
41	4952060	8687756	5700045	17543722	11510452	20193617	19
42	4954587	8686315	5703899	17531866	11512361	20183318	18
43	4957113	8684873	5707755	17520023	11514272	20173031	17
44	4959639	8683431	5711612	17508191	11516185	20162756	16
45	4962165	8681988	5715471	17496371	11518099	20152494	15
46	4964690	8680544	5719331	17484564	11520015	20142243	14
47	4967215	8679100	5723192	17472768	11521932	20132005	13
48	4969740	8677655	5727054	17460984	11523851	20121779	12
49	4972264	8676209	5730918	17449213	11525772	20111564	11
50	4974787	8674762	5734783	17437453	11527694	20101362	10
51	4977310	8673314	5738649	17425705	11529618	20091172	9
52	4979833	8671866	5742516	17413969	11531543	20080994	8
53	4982355	8670417	5746385	17402245	11533470	20070828	7
54	4984877	8668967	5750255	17390533	11535399	20060674	6
55	4987399	8667517	5754126	17378833	11537329	20050532	5
56	4989920	8666066	5757999	17367144	11539261	20040402	4
57	4992441	8664614	5761873	17355468	11541195	20030283	3
58	4994961	8663161	5765748	17343803	11543130	20020177	2
59	4997481	8661708	5769625	17332149	11545067	20010083	1
60	4000000	8660254	5773503	17320508	11547005	20000000	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

60 DEGREES.

Latitude 59 Deg. 00 Min. *North Declination.*

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.39	0	0.39	1	0.38	1	0.37	1	0.36	1	0.35	1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29	0	0.29
2	1.18	1	1.17	1	1.16	2	1.14	2	1.12	2	1.10	1	1.09	2	1.07	2	1.05	2	1.03	2	1.01	1	1.00	2	0.58
3	1.59	2	1.57	2	1.55	2	1.53	3	1.50	3	1.47	2	1.45	2	1.43	3	1.40	3	1.37	3	1.34	3	1.31	2	1.29
4	2.42	3	2.39	3	2.36	3	2.33	3	2.30	3	2.27	3	2.24	3	2.21	3	2.18	4	2.14	4	2.10	4	2.06	3	2.03
5	3.28	3	3.25	4	3.21	4	3.17	4	3.13	4	3.09	4	3.05	4	3.01	4	2.57	4	2.53	4	2.49	5	2.44	3	2.41
6	4.17	4	4.13	4	4.09	4	4.05	5	4.00	5	3.55	4	3.51	4	3.47	5	3.42	5	3.37	5	3.32	6	3.26	4	3.22
7	5.08	4	5.04	5	4.59	5	4.54	5	4.49	5	4.44	5	4.39	5	4.34	5	4.29	5	4.24	5	4.19	6	4.13	4	4.09
W E	6.00	4	5.56	5	5.51	5	5.46	5	5.41	5	5.36	5	5.31	5	5.26	5	5.21	6	5.15	6	5.09	5	5.04	5	4.59
1									6.35	6	6.29	5	6.24	5	6.19	5	6.14	5	6.09	6	6.03	5	5.58	5	5.53
2													7.20	6	7.14	6	7.08	5	7.03	5	6.58	5	6.53	4	6.49
3																	8.00	4	7.56	4	7.52	4	7.48	4	7.44
4																							8.43	5	8.38

29 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.6923388	9.9396968	9.7526420	10.2473580	10.0603032	10.3076612	30
31	9.6925620	9.9396253	9.7529368	10.2470632	10.0603747	10.3074380	29
32	9.6927851	9.9395537	9.7532314	10.2467686	10.0604463	10.3072149	28
33	9.6930080	9.9394821	9.7535259	10.2464741	10.0605179	10.3069920	27
34	9.6932308	9.9394105	9.7538203	10.2461797	10.0605895	10.3067692	26
35	9.6934534	9.9393388	9.7541146	10.2458854	10.0606612	10.3065466	25
36	9.6936758	9.9392671	9.7544088	10.2455912	10.0607329	10.3063242	24
37	9.6938981	9.9391953	9.7547029	10.2452971	10.0608047	10.3061019	23
38	9.6941203	9.9391234	9.7549969	10.2450031	10.0608766	10.3058797	22
39	9.6943423	9.9390515	9.7552908	10.2447092	10.0609485	10.3056577	21
40	9.6945642	9.9389796	9.7555846	10.2444154	10.0610204	10.3054358	20
41	9.6947859	9.9389076	9.7558783	10.2441217	10.0610924	10.3052141	19
42	9.6950074	9.9388356	9.7561718	10.2438282	10.0611644	10.3049926	18
43	9.6952288	9.9387635	9.7564653	10.2435347	10.0612365	10.3047712	17
44	9.6954501	9.9386914	9.7567587	10.2432413	10.0613086	10.3045499	16
45	9.6956712	9.9386192	9.7570520	10.2429480	10.0613808	10.3043288	15
46	9.6958922	9.9385470	9.7573452	10.2426548	10.0614530	10.3041078	14
47	9.6961130	9.9384747	9.7576383	10.2423617	10.0615253	10.3038870	13
48	9.6963336	9.9384024	9.7579313	10.2420687	10.0615976	10.3036664	12
49	9.6965541	9.9383300	9.7582242	10.2417758	10.0616700	10.3034459	11
50	9.6967745	9.9382576	9.7585170	10.2414830	10.0617424	10.3032255	10
51	9.6969947	9.9381851	9.7588096	10.2411904	10.0618149	10.3030053	9
52	9.6972148	9.9381126	9.7591022	10.2408978	10.0618874	10.3027852	8
53	9.6974347	9.9380400	9.7593947	10.2406053	10.0619600	10.3025653	7
54	9.6976545	9.9379674	9.7596871	10.2403129	10.0620326	10.3023455	6
55	9.6978741	9.9378947	9.7599794	10.2400206	10.0621053	10.3021259	5
56	9.6980936	9.9378220	9.7602716	10.2397284	10.0621780	10.3019064	4
57	9.6983129	9.9377492	9.7605637	10.2394363	10.0622508	10.3016871	3
58	9.6985321	9.9376764	9.7608557	10.2391443	10.0623236	10.3014679	2
59	9.6987511	9.9376035	9.7611476	10.2388524	10.0623965	10.3012489	1
60	9.6989700	9.9375306	9.7614394	10.2385606	10.0624694	10.3010300	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

60 DEGREES.

Latitude 59 Deg. 00 Min. *South Declination.*

	0	d.	2	d.	4	d	6	d	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.39	0	0.39	1	0.40	1	0.41	1	0.42	1	0.43	0	0.43	1	0.44	1	0.45	1	0.46	1	0.47	1	0.48	1	0.49
2	1.18	1	1.19	1	1.20	2	1.22	2	1.24	2	1.26	1	1.27	2	1.29	2	1.31	2	1.33	2	1.35	2	1.37	1	1.38
3	1.59	2	2.01	2	2.03	2	2.05	3	2.08	3	2.11	2	2.13	2	2.15	3	2.18	3	2.21	3	2.24	3	2.27	2	2.29
4	2.42	3	2.45	3	2.48	3	2.51	3	2.54	4	2.58	3	3.01	3	3.04	3	3.07	4	3.11	4	3.15				
5	3.28	4	3.31	4	3.35	4	3.39	4	3.43	4	3.47	4	3.51	4	3.55	4	3.59								
6	4.17	4	4.21	4	4.25	4	4.29	5	4.34	5	4.39														
7	5.08	5	5.13	5	5.18																				
W E																									

30 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N.Co-Secant.	
0	5000000	8660254	5773503	17320508	11547005	20000000	60
1	5002519	8658799	5777352	17305878	11548945	19989929	59
2	5005038	8657343	5781262	17297260	11550887	19979870	58
3	5007556	8655887	5785144	17285654	11552830	19969823	57
4	5010074	8654430	5789027	17274060	11554775	19959788	56
5	5012591	8652972	5792911	17262477	11556722	19949764	55
6	5015108	8651514	5796797	17250905	11558670	19939753	54
7	5017624	8650055	5800684	17239345	11560620	19929752	53
8	5020140	8648595	5804573	17227797	11562572	19919764	52
9	5022655	8647134	5808462	17216261	11564525	19909787	51
10	5025170	8645673	5812353	17204736	11566480	19899822	50
11	5027685	8644211	5816245	17193222	11568436	19889869	49
12	5030199	8642748	5820139	17181720	11570394	19879927	48
13	5032713	8641284	5824034	17170230	11572354	19869997	47
14	5035227	8639820	5827930	17158751	11574315	19860080	46
15	5037740	8638355	5831828	17147283	11576278	19850172	45
16	5040253	8636889	5835727	17135827	11578243	19840276	44
17	5042765	8635423	5839627	17124382	11580209	19830393	43
18	5045277	8633956	5843528	17112949	11582177	19820520	42
19	5047788	8632488	5847431	17101527	11584147	19810659	41
20	5050299	8631019	5851335	17090116	11586118	19800810	40
21	5052809	8629549	5855241	17078717	11588091	19790972	39
22	5055319	8628079	5859148	17067329	11590065	19781146	38
23	5057828	8626608	5863056	17055953	11592041	19771331	37
24	5060337	8625136	5866965	17044587	11594019	19761527	36
25	5062846	8623664	5870876	17033233	11595999	19751735	35
26	5065355	8622191	5874788	17021890	11597980	19741954	34
27	5067863	8620717	5878702	17010559	11599963	19732185	33
28	5070370	8619243	5882617	17999238	11601947	19722426	32
29	5072877	8617768	5886533	17987929	11603933	19712680	31
30	5075384	8616292	5890450	17976631	11605921	19702944	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N.Co-Secant.	N. Secant.	M

59 DEGREES.

Latitude 60 Deg. 00 Min. North Declination.

	0	d.	2	d.	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d.	18	d.	20	d.	22	d.	23½
	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m.	m	h. m	m.	h. m.
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.39	0	0.39	1	0.38	1	0.37	1	0.36	1	0.35	0	0.35	1	0.34	1	0.33	1	0.32	1	0.31	1	0.30	1	0.29
2	1.19	1	1.18	1	1.17	2	1.15	2	1.13	2	1.11	1	1.10	1	1.09	2	1.07	2	1.05	2	1.03	2	1.01	1	1.00
3	2.00	2	1.58	2	1.56	2	1.54	3	1.51	3	1.48	2	1.46	2	1.44	2	1.42	3	1.39	3	1.36	3	1.33	2	1.31
4	2.44	3	2.41	3	2.38	3	2.35	3	2.32	4	2.28	3	2.25	3	2.22	3	2.19	3	2.16	4	2.12	4	2.08	3	2.05
5	3.29	3	3.26	3	3.23	4	3.19	4	3.15	4	3.11	4	3.07	4	3.03	4	2.59	4	2.55	4	2.51	4	4.47	3	2.44
6	4.18	4	4.14	4	4.10	4	4.06	4	4.02	5	3.57	4	3.53	4	3.49	5	3.44	5	3.39	5	3.34	4	3.29	4	3.25
7	5.08	4	5.04	4	5.00	5	4.55	5	4.50	5	4.45	5	4.41	5	4.36	5	4.31	5	4.26	5	4.21	4	4.16	4	4.12
WE	6.00	4	5.56	5	5.51	5	5.46	5	5.41	5	5.36	5	5.31	5	5.26	5	5.21	5	5.16	5	5.11	5	5.06	4	5.02
1									6.34	5	6.29	5	6.24	5	6.19	5	6.14	5	6.09	5	6.04	5	5.59	4	5.55
2													7.19	5	7.14	5	7.09	5	7.04	5	6.59	5	6.54	4	6.50
3																	8.00	4	7.56	4	7.52	4	7.48	3	7.45
4																							8.41	2	8.39

30 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.6989700	9.9375306	9.7614394	10.2385606	10.0624694	10.3010300	60
1	9.6991887	9.9374577	9.7617311	10.2382689	10.0625423	10.3008113	59
2	9.6994073	9.9373847	9.7620227	10.2379773	10.0626153	10.3005927	58
3	9.6996258	9.9373116	9.7623142	10.2376858	10.0626884	10.3003742	57
4	9.6998441	9.9372385	9.7626056	10.2373944	10.0627615	10.3001559	56
5	9.7000622	9.9371653	9.7628969	10.2371031	10.0628347	10.2999378	55
6	9.7002802	9.9370921	9.7631881	10.2368119	10.0629079	10.2997198	54
7	9.7004981	9.9370189	9.7634792	10.2365208	10.0629811	10.2995019	53
8	9.7007158	9.9369456	9.7637702	10.2362298	10.0630544	10.2992842	52
9	9.7009334	9.9368722	9.7640612	10.2359388	10.0631278	10.2990666	51
10	9.7011508	9.9367988	9.7643520	10.2356480	10.0632012	10.2988492	50
11	9.7013681	9.9367254	9.7646427	10.2353573	10.0632746	10.2986319	49
12	9.7015852	9.9366519	9.7649334	10.2350666	10.0633481	10.2984148	48
13	9.7018022	9.9365783	9.7652239	10.2347761	10.0634217	10.2981978	47
14	9.7020190	9.9365047	9.7655143	10.2344857	10.0634953	10.2979810	46
15	9.7022357	9.9364311	9.7658047	10.2341953	10.0635689	10.2977663	45
16	9.7024523	9.9363574	9.7660949	10.2339051	10.0636426	10.2975477	44
17	9.7026687	9.9362836	9.7663851	10.2336149	10.0637164	10.2973313	43
18	9.7028849	9.9362098	9.7666751	10.2333249	10.0637902	10.2971151	42
19	9.7031011	9.9361360	9.7669651	10.2330349	10.0638640	10.2968989	41
20	9.7033170	9.9360621	9.7672550	10.2327450	10.0639379	10.2966830	40
21	9.7035329	9.9359881	9.7675448	10.2324552	10.0640119	10.2964671	39
22	9.7037486	9.9359141	9.7678344	10.2321656	10.0640859	10.2962514	38
23	9.7039641	9.9358401	9.7681240	10.2318760	10.0641599	10.2960359	37
24	9.7041795	9.9357660	9.7684135	10.2315865	10.0642340	10.2958205	36
25	9.7043947	9.9356918	9.7687029	10.2312971	10.0643082	10.2956052	35
26	9.7046099	9.9356177	9.7689922	10.2310078	10.0643823	10.2953901	34
27	9.7048248	9.9355434	9.7692814	10.2307186	10.0644566	10.2951752	33
28	9.7050397	9.9354691	9.7695705	10.2304295	10.0645309	10.2949603	32
29	9.7052543	9.9353948	9.7698596	10.2301404	10.0646052	10.2947457	31
30	9.7054689	9.9353204	9.7701485	10.2298515	10.0646796	10.2945311	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

59 DEGREES.

Latitude 60 Deg. 00 Min. South Declination.

	0	d	2	d	4	d.	6	d.	8	d.	10	d.	12	d.	14	d.	16	d	18	d.	20	d	22	d.	23½
	h. m.	m	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m	m.	h. m.	m.	h. m.	m.	h. m.	m.	h. m	m	h. m
S N	12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0		12.0
1	0.39	0	0.39	1	0.40	1	0.41	1	0.42	1	0.43	0	0.43	1	0.44	1	0.45	1	0.46	1	0.47	1	0.48	1	0.49
2	1.19	1	1.20	1	1.21	2	1.23	2	1.25	2	1.27	1	1.28	1	1.29	2	1.31	2	1.33	2	1.35	2	1.37	1	1.38
3	2.00	2	2.02	2	2.04	2	2.06	3	2.09	3	2.12	2	2.14	2	2.16	2	2.18	3	2.21	3	2.24	3	2.27	2	2.29
4	2.44	3	2.47	3	2.50	3	2.53	3	2.56	3	2.59	3	3.02	3	3.05	3	3.08	3	3.11	4	3.15				
5	3.29	3	3.32	4	3.36	4	3.40	4	3.44	4	3.48	3	3.51	3	3.54	4	3.58								
6	4.18	4	4.22	4	4.26	4	4.30	4	4.34	5	4.39	4	4.43												
7	5.08	4	5.12	4	5.16	5	5.21																		

30 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N.Co-Secant.	
30	5075384	8616292	5890450	16976631	11605921	19702944	30
31	5077890	8614815	5894369	16965344	11607911	19693220	29
32	5080396	8613337	5898289	16954069	11609902	19683507	28
33	5082901	8611859	5902211	16942804	11611895	19673805	27
34	5085406	8610380	5906134	16931550	11613889	19664114	26
35	5087910	8608900	5910058	16920308	11615885	19654434	25
36	5090414	8607420	5913983	16909077	11617883	19644767	24
37	5092918	8605939	5917910	16897856	11619882	19635110	23
38	5095421	8604457	5921839	16886647	11621883	19625464	22
39	5097924	8602974	5925768	16875449	11623886	19615829	21
40	5100426	8601491	5929699	16864261	11625891	19606206	20
41	5102928	8600007	5933632	16853085	11627897	19596593	19
42	5105429	8598522	5937566	16841919	11629905	19586992	18
43	5107930	8597037	5941501	16830765	11631914	19577401	17
44	5110431	8595551	5945437	16819621	11633925	19567822	16
45	5112931	8594064	5949375	16808489	11635938	19558254	15
46	5115431	8592576	5953314	16797367	11637953	19548697	14
47	5117930	8591088	5957254	16786256	11639969	19539150	13
48	5120429	8589599	5961196	16775156	11641987	19529615	12
49	5122927	8588109	5965140	16764067	11644007	19520091	11
50	5125425	8586618	5969084	16752988	11646028	19510577	10
51	5127922	8585127	5973030	16741921	11648051	19501075	9
52	5130419	8583635	5976978	16730864	11650076	19491583	8
53	5132916	8582142	5980927	16719818	11652102	19482102	7
54	5135412	8580649	5984877	16708782	11654130	19472632	6
55	5137908	8579155	5988828	16697758	11656165	19463173	5
56	5140404	8577660	5992781	16686744	11658191	19453725	4
57	5142899	8576164	5996735	16675741	11660224	19444288	3
58	5145393	8574668	6000691	16664748	11662259	19434861	2
59	5147887	8573171	6004648	16653766	11664296	19425445	1
60	5150381	8571673	6008606	16642795	11666334	19416040	0
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N.Tangent.	N.Co-Secant.	N. Secant.	M

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.7054689	9.9353204	9.7701485	10.2298515	10.0646796	10.2945311	30
31	9.7056833	9.9352459	9.7704373	10.2295627	10.0647541	10.2943167	29
32	9.7058975	9.9351715	9.7707261	10.2292739	10.0648285	10.2941025	28
33	9.7061116	9.9350969	9.7710147	10.2289853	10.0649031	10.2938884	27
34	9.7063256	9.9350223	9.7713033	10.2286967	10.0649777	10.2936744	26
35	9.7065394	9.9349477	9.7715917	10.2284083	10.0650523	10.2934606	25
36	9.7067531	9.9348730	9.7718801	10.2281199	10.0651270	10.2932469	24
37	9.7069667	9.9347983	9.7721684	10.2278316	10.0652017	10.2930333	23
38	9.7071801	9.9347235	9.7724566	10.2275434	10.0652765	10.2928199	22
39	9.7073933	9.9346486	9.7727447	10.2272553	10.0653514	10.2926067	21
40	9.7076064	9.9345738	9.7730327	10.2269673	10.0654262	10.2923936	20
41	9.7078194	9.9344988	9.7733206	10.2266794	10.0655012	10.2921806	19
42	9.7080323	9.9344238	9.7736084	10.2263916	10.0655762	10.2919677	18
43	9.7082450	9.9343488	9.7738961	10.2261039	10.0656512	10.2917550	17
44	9.7084575	9.9342737	9.7741838	10.2258162	10.0657263	10.2915425	16
45	9.7086699	9.9341986	9.7744713	10.2255287	10.0658014	10.2913301	15
46	9.7088822	9.9341234	9.7747588	10.2252412	10.0658766	10.2911178	14
47	9.7090943	9.9340482	9.7750462	10.2249538	10.0659518	10.2909057	13
48	9.7093063	9.9339729	9.7753334	10.2246666	10.0660271	10.2906937	12
49	9.7095182	9.9338976	9.7756206	10.2243794	10.0661024	10.2904818	11
50	9.7097299	9.9338222	9.7759077	10.2240923	10.0661778	10.2902701	10
51	9.7099415	9.9337467	9.7761947	10.2238053	10.0662533	10.2900585	9
52	9.7101529	9.9336713	9.7764816	10.2235184	10.0663287	10.2898471	8
53	9.7103642	9.9335957	9.7767685	10.2232315	10.0664043	10.2896358	7
54	9.7105753	9.9335201	9.7770552	10.2229448	10.0664799	10.2894247	6
55	9.7107863	9.9334445	9.7773418	10.2226582	10.0665555	10.2892137	5
56	9.7109972	9.9333688	9.7776284	10.2223716	10.0666312	10.2890028	4
57	9.7112080	9.9332931	9.7779149	10.2220851	10.0667069	10.2887920	3
58	9.7114186	9.9332173	9.7782012	10.2217988	10.0667827	10.2885814	2
59	9.7116290	9.9331415	9.7784875	10.2215125	10.0668585	10.2883710	1
60	9.7118393	9.9330656	9.7787737	10.2212263	10.0669344	10.2881607	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

59 DEGREES.

The Sun's Amplitude by the Point of the Compass.

Latitude	00		01		02		03		04		05		06		07		08		
☉ R. S.	Declina		Declina.		Declina		Declina.		Declina		Declina.		Declina		Declina.		Declin.		☉ R S
	Dg	Min	Deg	Min	Deg.	Min.	Dg	Min.	Deg.	Min	D g.	Min.	Deg	Min	Deg.	Min	D g.	Min.	
E W	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	E W
1	02	49	02	49	02	49	02	49	02	48	02	48	02	48	02	48	02	47	1
2	05	38	05	38	05	38	05	37	05	37	05	37	05	36	05	35	05	35	2
3	18	26	08	26	08	26	08	25	08	25	08	24	08	23	08	20	08	18	3
1	11	15	11	15	11	14	11	14	11	14	11	12	11	11	11	09	11	08	1
1	14	04	14	04	14	03	14	03	14	02	14	01	13	59	13	58	13	56	1
2	16	53	16	53	16	52	16	52	16	50	16	49	16	47	16	45	16	43	2
3	19	41	19	41	19	40	19	39	19	38	19	36	19	23	19	31	19	28	3
2	22	30	22	30	22	29	22	27	22	26	22	23	22	21	22	19	22	15	2

The Sun's Amplitude by the Point of the Compass.

Latitude	9		10		11		12		13		14		15		16		17		
☉ R. S.	Declina		Declina.		Declina.		Declina		Declina		Declina.		Declina.		Declina.		Declina		☉ R. S.
	Dg	Min.	Deg.	Min.	Dg.	Min	Dg.	Min.	Deg.	Min.	Dg	Min	D g.	Min	Dg	Min	D g.	Min.	
E W	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	E W
1	02	47	02	47	02	46	02	45	02	45	02	44	02	43	02	42	02	42	1
2	05	34	05	33	05	31	05	30	05	29	05	28	05	26	05	25	05	23	2
3	08	17	08	16	08	14	08	12	08	10	08	08	08	06	08	03	08	01	3
1	11	06	11	05	11	03	11	00	10	57	10	55	10	52	10	49	10	45	1
1	13	53	13	51	13	48	13	45	13	42	13	38	13	35	13	31	13	26	1
2	16	40	16	37	16	33	16	00	16	26	16	22	16	17	16	12	16	08	2
3	19	25	19	21	19	18	19	14	19	09	19	04	18	59	18	53	18	47	3
2	22	12	22	07	22	03	21	58	21	53	21	47	21	41	21	34	21	27	2

31 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	5150381	8571673	6008606	16642795	11666334	19416040	60
1	5152874	8570174	6012566	16631834	11668374	19406646	59
2	5155367	8568675	6016527	16620884	11670416	19397262	58
3	5157859	8567175	6020490	16609945	11672459	19387889	57
4	5160351	8565674	6024454	16599016	11674504	19378527	56
5	5162842	8564173	6028419	16588097	11676551	19369176	55
6	5165333	8562671	6032386	16577189	11678599	19359835	54
7	5167824	8561168	6036354	16566292	11680649	19350505	53
8	5170314	8559664	6040323	16555405	11682701	19341185	52
9	5172804	8558160	6044294	16544529	11684755	19331876	51
10	5175293	8556655	6048266	16533663	11686810	19322578	50
11	5177782	8555149	6052240	16522808	11688867	19313290	49
12	5180270	8553642	6056215	16511963	11690926	19304013	48
13	5182758	8552135	6060192	16501128	11692986	19294746	47
14	5185245	8550627	6064170	16490304	11695048	19285490	46
15	5187733	8549118	6068149	16479490	11697112	19276244	45
16	5190219	8547609	6072130	16468686	11699178	19267009	44
17	5192705	8546099	9076112	16457893	11701245	19257784	43
18	5195191	8544588	6080095	16447111	11703314	19248570	42
19	5197676	8543076	6084080	16436338	11705385	19239366	41
20	5200161	8541564	6088067	16425576	11707457	19230173	40
21	5202646	8540051	6092054	16414824	11709531	19220990	39
22	5205130	8538537	6096043	16404082	11711607	19211817	38
23	5207613	8537023	6100034	16393351	11713685	19202655	37
24	5210096	8535508	6104026	16382630	11715764	19193503	36
25	5212579	8533992	6108019	16371919	11717845	19184362	35
26	5215061	8532475	6112014	16361218	11719928	19175230	34
27	5217543	8530958	6116011	16350528	11722013	19166109	33
28	5220024	8529440	6120008	16339847	11724099	19156999	32
29	5222505	8527921	6124007	16329177	11726187	19147899	31
30	5224986	8526402	6128008	16318517	11728277	19138809	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

58 DEGREES.

The Sun's Amplitude by the Point of the Compass.

Latitude		18		19		20		21		22		23		24		25		26			
⊙ R. S.		Declina.		Declina.		Declina.		Declina.		Declina.		Declina.		Declina.		Declina.		Declina.		⊙ R. S.	
		Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min	Deg	Min		
E W		00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	E W	
	1	02	41	02	40	02	39	02	38	02	37	02	36	02	35	02	33	02	32		1
	2	05	22	05	20	05	17	05	15	05	13	05	11	05	09	05	06	05	04		2
	3	07	59	07	56	07	52	07	50	07	47	07	43	07	39	07	36	07	32		3
1		10	42	10	38	10	34	10	30	10	25	10	21	10	16	10	11	10	06	1	
	1	13	22	13	17	13	12	13	07	13	01	12	56	12	50	12	43	12	35		1
	2	16	02	15	56	15	51	15	44	15	38	15	31	15	23	15	16	15	08		2
	3	18	40	18	33	18	27	18	19	18	11	18	03	17	54	17	46	17	37		3
2		21	20	21	13	21	05	20	55	20	46	20	37	20	28	20	18	20	07	2	
	1							23	32	23	22	23	11	23	00	22	48	22	36		1

31 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.7118393	9.9330656	9.7787737	10.2212263	10.0669344	10.2881607	60
1	9.7120495	9.9329897	9.7790599	10.2209401	10.0670103	10.2879505	59
2	9.7122596	9.9329137	9.7793459	10.2206541	10.0670863	10.2877404	58
3	9.7124695	9.9328376	9.7796318	10.2203682	10.0671624	10.2875305	57
4	9.7126792	9.9327616	9.7799177	10.2200823	10.0672384	10.2873208	56
5	9.7128889	9.9326854	9.7802034	10.2197966	10.0673146	10.2871111	55
6	9.7130983	9.9326092	9.7804891	10.2195109	10.0673908	10.2869017	54
7	9.7133077	9.9325330	9.7807747	10.2192253	10.0674670	10.2866923	53
8	9.7135169	9.9324567	9.7810602	10.2189398	10.0675433	10.2864831	52
9	9.7137260	9.9323804	9.7813456	10.2186544	10.0676196	10.2862740	51
10	9.7139349	9.9323040	9.7816309	10.2183691	10.0676960	10.2860651	50
11	9.7141437	9.9322276	9.7819162	10.2180838	10.0677724	10.2858563	49
12	9.7143524	9.9321511	9.7822013	10.2177987	10.0678489	10.2856476	48
13	9.7145609	9.9320746	9.7824864	10.2175136	10.0679254	10.2854391	47
14	9.7147693	9.9319980	9.7827713	10.2172287	10.0680020	10.2852307	46
15	9.7149776	9.9319213	9.7830562	10.2169438	10.0680787	10.2850224	45
16	9.7151857	9.9318447	9.7833410	10.2166590	10.0681553	10.2848143	44
17	9.7153937	9.9317679	9.7836258	10.2163742	10.0682321	10.2846063	43
18	9.7156015	9.9316911	9.7839104	10.2160896	10.0683089	10.2843985	42
19	9.7158092	9.9316143	9.7841949	10.2158051	10.0683857	10.2841908	41
20	9.7160168	9.9315374	9.7844794	10.2155206	10.0684626	10.2839832	40
21	9.7162243	9.9314605	9.7847638	10.2152362	10.0685395	10.2837757	39
22	9.7164316	9.9313835	9.7850481	10.2149519	10.0686165	10.2835684	38
23	9.7166387	9.9313065	9.7853323	10.2146677	10.0686935	10.2833613	37
24	9.7168458	9.9312294	9.7856164	10.2143836	10.0687706	10.2831542	36
25	9.7170526	9.9311522	9.7859004	10.2140996	10.0688478	10.2829474	35
26	9.7172594	9.9310750	9.7861844	10.2138156	10.0689250	10.2827406	34
27	9.7174660	9.9309978	9.7864682	10.2135318	10.0690022	10.2825340	33
28	9.7176725	9.9309205	9.7867520	10.2132480	10.0690795	10.2823275	32
29	9.7178789	9.9308432	9.7870357	10.2129643	10.0691568	10.2821211	31
30	9.7180851	9.9307658	9.7873193	10.2126807	10.0692342	10.2819149	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

58 DEGREES.

The Sun's Amplitude by the Point of the Compass.

Latitude		27		28		29		30		31		22		33		34		35			
⊙ R. S.		Declina.		Declina.		Declina.		Declina.		Declina.		Declina.		Declina.		Declina.		Declina.		⊙ R. S.	
		Deg	Min	Deg.	Min	Deg.	Min	Deg	Min	Deg.	Min	Deg	Min	Deg.	Min	Deg.	Min	Deg.	Min		
E W		00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	E W	
	1	02	31	02	29	02	29	02	27	02	25	02	23	02	22	02	20	02	18		1
	2	05	01	04	58	04	55	04	52	04	50	04	46	04	43	04	40	04	37		2
	3	07	28	07	24	07	20	07	18	07	13	07	03	07	04	06	59	06	54		3
1		10	01	09	55	09	50	09	44	09	38	09	31	09	25	09	18	09	12	1	
	1	12	30	12	24	12	17	12	09	12	01	11	54	11	46	11	38	11	29		1
	2	15	00	14	51	14	43	14	34	14	25	14	16	14	05	13	56	13	46		2
	3	17	28	17	17	17	07	16	57	16	47	16	36	16	24	16	12	16	02		3
2		19	56	19	45	19	33	19	21	19	09	18	55	18	43	18	30	18	16	2	
	1	22	23	22	11	21	58	21	44	21	30	21	16	21	01	20	46	20	30		1
	2													23	18	23	01	22	43		2

31 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N.Co-Secan.	
30	5224986	8526402	6128008	16318517	11728277	19138809	30
31	5227466	8524881	6132010	16307867	11730369	19129729	29
32	5229945	8523360	6136013	16297227	11732462	19120659	28
33	5232424	8521838	6140018	16286597	11734557	19111600	27
34	5234903	8520316	6144024	16275977	11736654	19102551	26
35	5237381	8518793	9148032	16265368	11738752	19093512	25
36	5239859	8517269	6152041	16254768	11740852	19084483	24
37	5242336	8515744	6156052	16244178	11742954	19075464	23
38	5244813	8514219	6160064	16233599	11745058	19066456	22
39	5247290	8512693	6164077	16223029	11747164	19057457	21
40	5249766	8511166	6168092	16212469	11749271	19048469	20
41	5252241	8509639	6172108	16201920	11751380	19039491	19
42	5254716	8508111	6176126	16191380	11753491	19030522	18
43	5257191	8506582	6180145	16180850	11755603	19021564	17
44	5249665	8505052	6184165	16170330	11757717	19012616	16
45	5262139	8503522	6188188	16159820	11759833	19003678	15
46	5264612	8501991	6192211	16149320	11761951	18994750	14
47	5267085	8500459	6196236	16138829	11764070	18985832	13
48	5269558	8498927	6200263	16128349	11766191	18976924	12
49	5272030	8497394	6204291	16117878	11768314	18968026	11
50	5274502	8495860	6208320	16107417	11770439	18959138	10
51	5276973	8494325	6212351	16096966	11772566	18950259	9
52	5279444	8492790	6216383	16086525	11774694	18941391	8
53	5281914	8491254	6220417	16076094	11776824	18932532	7
54	5284384	8489717	6224452	16065672	11778956	18923684	6
55	5286853	8488179	6228488	16055260	11781090	18914845	5
56	5289322	8486641	6232526	16044858	11783225	18906016	4
57	5291790	8485102	6236566	16034465	11785362	18897197	3
58	5294258	8483562	6240607	16024082	11787501	18888388	2
59	5296726	8482022	6244640	16013709	11789642	18879589	1
60	5299193	8480481	6248694	16003345	11791784	18870799	0
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co Secant.	N. Secant.	M

58 DEGREES.

The Sun's Amplitude by the Point of the Compaß.

Latitude	26		37		38		39		40		41		42		43		44		
☉ R. S.	Declina		Declina.		Declina		Declina		Declina.		Declina.		Declina.		Declina		Declin		☉ R. S.
	Deg	Min	Deg	Min	Deg	Min	Deg.	Min	Deg.	Min	Deg.	Min	Deg	Min	Deg.	Min	Deg	Min	
E W	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	E W
1	02	16	02	15	02	13	02	11	02	09	02	07	02	06	02	04	02	01	1
2	04	33	04	30	04	26	04	22	04	19	04	15	04	11	04	07	04	03	2
3	06	49	06	43	06	38	06	32	06	27	06	22	06	16	06	10	06	04	3
1	09	05	08	58	08	50	08	43	08	36	08	28	08	20	08	12	08	0[illegible]	1
1	11	21	11	12	11	03	10	53	10	43	10	34	10	24	10	14	10	04	1
2	13	35	13	25	13	14	13	03	12	51	12	40	12	28	12	16	12	03	2
3	15	49	15	36	15	23	15	10	14	57	14	44	14	30	14	16	14	01	3
2	18	02	17	48	17	33	17	18	17	03	16	47	16	31	16	15	15	59	2
1	20	15	19	58	19	41	19	25	19	07	18	50	18	32	18	14	17	54	1
2	22	25	22	07	21	49	21	30	21	10	20	51	20	31	20	10	19	50	2
3							23	32	23	11	22	50	22	27	22	05	21	42	3
3																	23	32	3

31 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.7180851	9.9307658	9.7873193	10.2126807	10.0692342	10.2819149	30
31	9.7182912	9.9306883	9.7876028	10.2123972	10.0693117	10.2817088	29
32	9.7184971	9.9306109	9.7878863	10.2121137	10.0693891	10.2815029	28
33	9.7187030	9.9305333	9.7881696	10.2118304	10.0694667	10.2812970	27
34	9.7189086	9.9304557	9.7884529	10.2115471	10.0695443	10.2810914	26
35	9.7191142	9.9303781	9.7887361	10.2112639	10.0696219	10.2808858	25
36	9.7193196	9.9303004	9.7890192	10.2109808	10.0696996	10.2806804	24
37	9.7195249	9.9302226	9.7893023	10.2106977	10.0697774	10.2804751	23
38	9.7197300	9.9301448	9.7895852	10.2104148	10.0698552	10.2802700	22
39	9.7199350	9.9300670	9.7898681	10.2101319	10.0699330	10.2800650	21
40	9.7201399	9.9299891	9.7901508	10.2098492	10.0700109	10.2798601	20
41	9.7203447	9.9299112	9.7904335	10.2095665	10.0700888	10.2796553	19
42	9.7205493	9.9298332	9.7907161	10.2092839	10.0701668	10.2794507	18
43	9.7207538	9.9297551	9.7909987	10.2090013	10.0702449	10.2792462	17
44	9.7209581	9.9296770	9.7912811	10.2087189	10.0703230	10.2790419	16
45	9.7211623	9.9295989	9.7915635	10.2084365	10.0704011	10.2788377	15
46	9.7213664	9.9295207	9.7918458	10.2081542	10.0704793	10.2786336	14
47	9.7215704	9.9294424	9.7921280	10.2078720	10.0705576	10.2784296	13
48	9.7217742	9.9293641	9.7924101	10.2075899	10.0706359	10.2782258	12
49	9.7219779	9.9292857	9.7926921	10.2073079	10.0707143	10.2780221	11
50	9.7221814	9.9292073	9.7929741	10.2070259	10.0707927	10.2778186	10
51	9.7223848	9.9291289	9.7932560	10.2067440	10.0708711	10.2776152	9
52	9.7225881	9.9290504	9.7935378	10.2064622	10.0709496	10.2774119	8
53	9.7227913	9.9289718	9.7938195	10.2061805	10.0710283	10.2772087	7
54	9.7229943	9.9288932	9.7941011	10.2058989	10.0711068	10.2770057	6
55	9.7231972	9.9288145	9.7943827	10.2056173	10.0711855	10.2768028	5
56	9.7234000	9.9287358	9.7946641	10.2053359	10.0712643	10.2766030	4
57	9.7236026	9.9286571	9.7949455	10.2050545	10.0713429	10.2763974	3
58	9.7238051	9.9285783	9.7952268	10.2047732	10.0714217	10.2761949	2
59	9.7240075	9.9284994	9.7955081	10.2044919	10.0715006	10.2759925	1
60	9.7242097	9.9284205	9.7957892	10.2042108	10.0715795	10.2757903	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

58 DEGREES.

The Sun's Amplitude by the Point of the Compaß.

Latitude	45		46		47		48		49		50		51		52		53		
☉ R. S.	Declina		Declina.		Declina		Declina.		Declina		Declina		Declina.		Declina		Declina.		☉ R. S.
	Deg	Min	Deg.	Min	Deg	Min	Deg	Min	Deg.	Min	Deg	Min	Deg.	Min	Deg	Min	Deg.	Min	
E W	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	E W
1	02	00	01	58	01	55	01	53	01	51	01	48	01	46	01	44	01	42	1
2	03	59	03	55	03	50	03	46	03	42	03	37	03	33	03	28	03	23	2
3	05	57	05	51	05	45	05	38	05	31	05	25	05	18	05	11	05	04	3
1	07	56	07	47	07	39	07	30	07	22	07	12	07	01	06	54	06	44	1
1	09	54	09	43	09	33	09	22	09	10	08	59	08	48	08	37	08	25	1
2	11	51	11	38	11	25	11	12	10	59	10	46	10	32	10	18	10	04	2
3	13	45	13	32	13	17	13	01	12	46	12	30	12	14	11	58	11	41	3
2	15	42	15	25	15	08	14	50	14	28	14	14	13	56	13	37	13	19	2
1	17	36	17	17	16	57	16	38	16	17	15	57	15	36	15	16	14	55	1
2	19	30	19	07	18	46	18	24	18	01	17	39	17	16	16	52	16	29	2
3	21	19	20	55	20	31	20	07	19	42	19	18	18	52	18	27	18	01	3
3	23	08	22	42	22	16	21	49	21	22	20	55	20	28	20	00	19	32	3
1							23	29	23	01	22	31	22	01	21	31	21	01	1
2													23	32	23	00	22	27	

32 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	5299193	8480481	6248694	16003345	11791784	18870799	60
1	5301659	8478939	6252739	15992991	11793928	18862019	59
2	5304125	8477396	6256786	15982647	11796074	18853249	58
3	5306591	8475853	6260834	15972312	11798222	18844489	57
4	5309056	8474309	6264884	15961987	11800372	18835738	56
5	5311521	8472764	6268935	15951672	11802523	18826997	55
6	5313986	8471219	6272988	15941366	11804676	18818266	54
7	5316450	8469673	6277042	15931070	11806831	18809545	53
8	5318913	8468126	6281098	15920783	11808988	18800833	52
9	5321376	8466578	6285156	15910505	11811147	18792131	51
10	5323839	8465030	6289215	15900238	11813307	18783438	50
11	5326301	8463481	6293275	15889979	11815469	18774755	49
12	5328763	8461931	6297336	15879730	11817633	18766082	48
13	5331224	8460381	6301399	15869491	11819799	18757418	47
14	5333685	8458830	6305464	15859261	11821966	18748764	46
15	5336145	8457278	6309530	15849041	11824135	18740120	45
16	5338605	8455725	6313598	15838830	11826306	18731485	44
17	5341064	8454172	6317667	15828628	11828479	18722859	43
18	5343523	8452618	6321738	15818436	11830654	18714243	42
19	5345982	8451063	6325810	15808253	11832830	18705637	41
20	5348440	8449508	6329883	15798079	11835008	18697040	40
21	5350898	8447952	6333958	15787915	11837188	18688453	39
22	5353355	8446395	6338035	15777760	11839370	18679875	38
23	5355812	8444837	6342113	15767615	11841554	18671306	37
24	5358268	8443279	6346193	15757479	11843740	18662747	36
25	5360724	8441720	6350274	15747352	11845927	18654197	35
26	5363179	8440160	6354357	15737234	11848116	18645657	34
27	5365634	8438600	6358441	15727126	11850307	18637126	33
28	5368089	8437039	6362527	15717026	11852500	18628605	32
29	5370542	8435477	6366614	15706936	11854694	18620093	31
30	5372996	8433914	6370703	15696856	11856891	18611590	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

57 DEGREES.

The Sun's Amplitude by the Point of the Compass.

Latitude	54		55		56		57		58		59		60		
☉ R. S.	Declination		Declination		Declination		Declination		Declination		Declination.		Declination		☉ R. S.
	Deg	Min	Deg	Min	Deg.	Min.	Deg	Min	Deg	Min	Deg	Min	Deg.	Min	
E W	00	00	00	00	00	00	00	00	00	00	00	00	00	00	E W
1	01	39	01	37	01	34	01	32	01	30	01	27	01	25	1
2	03	18	03	14	03	09	03	04	02	59	02	54	02	49	2
3	04	57	04	49	04	42	04	35	04	28	04	20	04	12	3
1	06	35	06	25	06	16	06	06	05	56	05	46	05	36	1
1	08	13	08	01	07	49	07	36	07	24	07	11	06	59	1
2	09	50	09	35	09	21	09	06	08	51	08	36	08	21	2
3	11	25	11	08	10	51	10	34	10	17	10	00	09	42	3
2	13	00	12	41	12	22	12	01	11	42	11	22	11	02	2
1	14	33	14	12	13	50	13	28	03	06	12	42	12	21	1
2	16	05	15	42	15	18	14	53	14	28	14	03	13	38	2
3	17	35	17	09	16	42	16	16	15	48	15	21	14	53	3
3	19	03	18	35	18	06	17	37	17	07	16	37	16	08	3
1	20	30	19	59	19	28	18	56	18	24	17	52	17	20	1
2	21	54	21	21	20	47	20	13	19	38	19	04	18	30	2
3	23	15	22	39	22	03	21	27	20	50	20	14	19	38	3
4					23	18	22	39	22	00	21	22	20	42	4
1									23	08	22	26	21	45	1
2											23	27	22	44	2

32 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.7242097	9.9284205	9.7957892	10.2042108	10.0715795	10.2757903	60
1	9.7244118	9.9283415	9.7960703	10.2039297	10.0716585	10.2755882	59
2	9.7246138	9.9282625	9.7963513	10.2036487	10.0717375	10.2753862	58
3	9.7248156	9.9281834	9.7966322	10.2033678	10.0718166	10.2751844	57
4	9.7250174	9.9281043	9.7969130	10.2030870	10.0718957	10.2749826	56
5	9.7252189	9.9280251	9.7971938	10.2028062	10.0719749	10.2747811	55
6	9.7254204	9.9279459	9.7974745	10.2025255	10.0720541	10.2745796	54
7	9.7256217	9.9278666	9.7977551	10.2022449	10.0721334	10.2743783	53
8	9.7258229	9.9277873	9.7980356	10.2019644	10.0722127	10.2741771	52
9	9.7260240	9.9277079	9.7983160	10.2016840	10.0722921	10.2739760	51
10	9.7262249	9.9276285	9.7985964	10.2014036	10.0723715	10.2737751	50
11	9.7264257	9.9275490	9.7988767	10.2011233	10.0724510	10.2735743	49
12	9.7266264	9.9274695	9.7991569	10.2008431	10.0725305	10.2733736	48
13	9.7268269	9.9273899	9.7994370	10.2005630	10.0726101	10.2731731	47
14	9.7270273	9.9273103	9.7997170	10.2002830	10.0726897	10.2729727	46
15	9.7272276	9.9272306	9.7999970	10.2000030	10.0727694	10.2727724	45
16	9.7274278	9.9271509	9.8002769	10.1997231	10.0728491	10.2725722	44
17	9.7276278	9.9270711	9.8005567	10.1994433	10.0729289	10.2723722	43
18	9.7278277	9.9269913	9.8008365	10.1991635	10.0730087	10.2721723	42
19	9.7280275	9.9269114	9.8011161	10.1988839	10.0730886	10.2719725	41
20	9.7282271	9.9268314	9.8013957	10.1986043	10.0731686	10.2717729	40
21	9.7284267	9.9267514	9.8016752	10.1983248	10.0732486	10.2715733	39
22	9.7286260	9.9266714	9.8019546	10.1980454	10.0733286	10.2713740	38
23	9.7288253	9.9265913	9.8022340	10.1977660	10.0734087	10.2711747	37
24	9.7290244	9.9265112	9.8025133	10.1974867	10.0734888	10.2709756	36
25	9.7292234	9.9264310	9.8027925	10.1972075	10.0735690	10.2707766	35
26	9.7294223	9.9263507	9.8030716	10.1969284	10.0736493	10.2705777	34
27	9.7296211	9.9262704	9.8033506	10.1966494	10.0737296	10.2703789	33
28	9.7298197	9.9261901	9.8036296	10.1963704	10.0738099	10.2701803	32
29	9.7300182	9.9261096	9.8039085	10.1960915	10.0738904	10.2699818	31
30	9.7302165	9.9260292	9.8041873	10.1958127	10.0739708	10.2697835	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

57 DEGREES.

of the Chiefest Places of the World.

The Sea-coast of England from the Lizard to Newcastle.

The Places Names.	*North Latitud.* D.	M.	*East Longit.* D.	M.
The Lizard	50	10	0	00
Falmouth	50	22	0	12
Foy	50	35	0	34
Ramhead	50	34	0	40
Plimouth	50	36	0	51
The Ediſtone	50	22	0	44
The Start	50	27	1	10
Dartmouth	50	37	1	28
Torbay	50	42	1	36
The Bary	50	40	1	35
Abſom Bar	50	47	1	37
Lime	50	55	2	10
Chiddock	50	57	2	14
Portland	50	50	2	36
Weymouth	51	3	2	44
Pool	51	4	3	34
Iſle of Wight	50	58	4	08

32 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	5372996	8433914	6370703	15696856	11856891	18611590	30
31	5375449	8432351	6374793	15686784	11859089	18603096	29
32	5377902	8430787	6378885	15676722	11861289	18594612	28
33	5380354	8429222	6382978	15666669	11863491	18586138	27
34	5382806	8427657	6387073	15656625	11865695	18577672	26
35	5385257	8426091	6391169	15646590	11867900	18569216	25
36	5387708	8424524	6395267	15636564	11870107	18560769	24
37	5390158	8422956	6399366	15626548	11872316	18552331	23
38	5392608	8421388	6403467	15616540	11874527	18543903	22
39	5395058	8419819	6407569	15606542	11876740	18535483	21
40	5397507	8418249	6411673	15596552	11878955	18527073	20
41	5399955	8416679	6415779	15586572	11881171	18518672	19
42	5402403	8415108	6419886	15576601	11883389	18510281	18
43	5404851	8413536	6423995	15566639	11885609	18501898	17
44	5407298	8411963	6428105	15556685	11887831	18493525	16
45	5409745	8410390	6432216	15546741	11890055	18485161	15
46	5412191	8408816	6436329	15536806	11892281	18476805	14
47	5414637	8407241	6440444	15526880	11894508	18468459	13
48	5417082	8405666	6444560	15516963	11896737	18460123	12
49	5419527	8404090	6448678	15507054	11898968	18451795	11
50	5421971	8402513	6452797	15497155	11901201	18443476	10
51	5424415	8400935	6456918	15487264	11903436	18435166	9
52	5426859	8399357	6461041	15477383	11905673	18426866	8
53	5429302	8397778	6465165	15467510	11907912	18418574	7
54	5431744	8396198	6469290	15457646	11910152	18410292	6
55	5434186	8394618	6473417	15447792	11912394	18402018	5
56	5436628	8393037	6477546	15437946	11914638	18393753	4
57	5439069	8391455	6481676	15428108	11916884	18385498	3
58	5441510	8389873	6485808	15418280	11919132	18377251	2
59	5443950	8388290	6489941	15408460	11921382	18369013	1
60	5446390	8386706	6494076	15398650	11923633	18360784	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

57 DEGREES.

A Table of the Latitude and Longitude

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.	The Places Names.	North Latitud D.	North Latitud M.	East Longit. D.	East Longit. M.
Portsmouth	51	8	4	24	North Foreland	51	28	6	44
Shoram	51	7	4	57	Margaret	51	29	6	34
Beache	50	58	5	15	Quinborow	51	30	6	01
Rye	51	13	6	09	Rochester	51	28	5	54
Dongeness	51	9	5	15	London	51	32	5	24
Dover	51	25	6	32	Gravesend	51	35	5	44
Ripraps	51	13	6	49	Tilbury Hope	51	38	5	54
The South Foreland	51	22	6	44	Colchester	52	04	6	02
The Downs	51	25	6	45	Harwich	52	11	6	27
Sandwich	51	27	6	33	Ipswich	52	14	6	24

32 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.7302165	9.9260292	9.8041873	10.1958127	10.0739708	10.2697835	30
31	9.7304148	9.9259487	9.8044661	10.1955339	10.0740513	10.2695852	29
32	9.7306129	9.9258681	9.8047447	10.1952553	10.0741319	10.2693871	28
33	9.7308109	9.9257875	9.8050233	10.1949767	10.0742125	10.2691891	27
34	9.7310087	9.9257069	9.8053019	10.1946981	10.0742931	10.2689913	26
35	9.7312064	9.9256261	9.8055803	10.1944197	10.0743739	10.2687936	25
36	9.7314040	9.9255454	9.8058587	10.1941413	10.0744546	10.2685960	24
37	9.7316015	9.9254646	9.8061370	10.1938630	10.0745354	10.2683985	23
38	9.7317989	9.9253837	9.8064152	10.1935848	10.0746163	10.2682011	22
39	9.7319961	9.9253028	9.8066933	10.1933067	10.0746972	10.2680039	21
40	9.7321932	9.9252218	9.8069714	10.1930286	10.0747782	10.2678068	20
41	9.7323902	9.9251408	9.8072494	10.1927506	10.0748592	10.2676098	19
42	9.7325870	9.9250597	9.8075273	10.1924727	10.0749403	10.2674130	18
43	9.7327837	9.9249786	9.8078052	10.1921948	10.0750214	10.2672163	17
44	9.7329803	9.9248974	9.8080829	10.1919171	10.0751026	10.2670197	16
45	9.7331768	9.9248161	9.8083606	10.1916394	10.0751839	10.2668232	15
46	9.7333731	9.9247349	9.8086383	10.1913617	10.0752651	10.2666269	14
47	9.7335693	9.9246535	9.8089158	10.1910842	10.0753465	10.2664307	13
48	9.7337654	9.9245721	9.8091933	10.1908067	10.0754279	10.2662346	12
49	9.7339614	9.9244907	9.8094707	10.1905293	10.0755093	10.2660386	11
50	9.7341572	9.9244092	9.8097480	10.1902520	10.0755908	10.2658428	10
51	9.7343529	9.9243277	9.8100253	10.1899747	10.0756723	10.2656471	9
52	9.7345485	9.9242461	9.8103025	10.1896975	10.0757539	10.2654515	8
53	9.7347440	9.9241644	9.8105796	10.1894204	10.0758356	10.2652560	7
54	9.7349393	9.9240827	9.8108566	10.1891434	10.0759173	10.2650607	6
55	9.7351345	9.9240010	9.8111336	10.1888664	10.0759990	10.2648655	5
56	9.7353296	9.9239191	9.8114105	10.1885895	10.0760809	10.2646704	4
57	9.7355246	9.9238373	9.8116873	10.1883127	10.0761627	10.2644754	3
58	9.7357195	9.9237554	9.8119641	10.1880359	10.0762446	10.2642805	2
59	9.7359142	9.9236734	9.8122408	10.1877592	10.0763266	10.2640858	1
60	9.7361088	9.9235914	9.8125174	10.1874826	10.0764086	10.2638912	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

57 DEGREES.

of the Chiefest Places of the World.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.	The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Orfordness	52	20	6	35	Hull	53	45	4	16
Alborow	52	24	6	39	The Sporne	53	45	5	01
Yarmouth	52	45	6	42	Burlington	54	00	4	28
Winterton	52	52	6	46	Flamborough Head	54	8	4	35
Cromar	53	20	6	41	Scarborough	54	20	4	21
Blackness	53	4	6	19	Whitby	54	35	4	10
Wells	53	7	6	02	Hartlepool	54	37	3	29
Lin	52	58	5	33	Sunderland	54	47	3	26
Boston	53	9	5	02	Shelds	55	02	3	24
Grimsbe	53	39	4	28	Newcastle.	54	58	3	14

33 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	5446390	8386706	6494076	15398650	11923633	18360784	60
1	5448830	8385121	6498212	15388848	11925886	18352564	59
2	5451269	8383536	6502350	15379055	11928141	18344353	58
3	5453707	8381950	6506490	15369270	11930398	18336151	57
4	5456145	8380363	6510631	15359494	11932657	18327958	56
5	5458583	8378775	6514774	15349727	11934918	18319774	55
6	5461020	8377187	6518918	15339969	11937181	18311599	54
7	5463456	8375598	6523064	15330220	11939446	18303432	53
8	5465892	8374009	6527211	15320479	11941712	18295274	52
9	5468328	8372418	6531360	15310747	11943980	18287125	51
10	5470763	8370827	6535511	15301023	11946250	18278985	50
11	5473198	8369235	6539663	15291308	11948522	18270854	49
12	5475632	8367643	6543817	15281602	11950790	18262731	48
13	5478065	8366050	6547972	15271904	11953072	18254617	47
14	5480499	8364456	6552129	15262215	11955350	18246512	46
15	5482932	8362861	6556287	15252535	11957630	18238416	45
16	5485365	8361266	6560447	15242863	11959911	18230328	44
17	5487797	8359670	6564609	15233200	11962194	18222249	43
18	5490228	8358073	6568772	15223545	11964479	18214179	42
19	5492659	8356476	6572937	15213899	11966766	18206118	41
20	5495090	8354878	6577103	15204261	11969055	18198065	40
21	5497520	8353279	6581271	15194632	11971345	18190021	39
22	5499950	8351680	6585441	15185012	11973639	18181985	38
23	5502379	8350080	6589612	15175400	11975934	18173958	37
24	5504808	8348479	6593785	15165796	11978231	18165940	36
25	5507236	8346877	6597959	15156201	11980529	18157930	35
26	5509664	8345275	6602135	15146614	11982829	18149929	34
27	5512091	8343672	6606313	15137036	11985131	18141937	33
28	5514518	8342068	6610492	15127466	11987435	18133953	32
29	5516944	8340463	6614673	15117905	11989741	18125977	31
30	5519370	8338858	6618856	15108352	11992049	18118010	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

56 DEGREES.

33 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.7361088	9.9235914	9.8125174	10.1874826	10.0764086	10.2638912	60
1	9.7363032	9.9235093	9.8127939	10.1872061	10.0764907	10.2636968	59
2	9.7364976	9.9234272	9.8130704	10.1869296	10.0765728	10.2635024	58
3	9.7366918	9.9233450	9.8133468	10.1866532	10.0766550	10.2633082	57
4	9.7368859	9.9232628	9.8136231	10.1863769	10.0767372	10.2631141	56
5	9.7370799	9.9231805	9.8138993	10.1861007	10.0768195	10.2629201	55
6	9.7372737	9.9230982	9.8141755	10.1858245	10.0769018	10.2627263	54
7	9.7374675	9.9230158	9.8144516	10.1855484	10.0769842	10.2625325	53
8	9.7376611	9.9229334	9.8147277	10.1852723	10.0770666	10.2623389	52
9	9.7378546	9.9228509	9.8150036	10.1849964	10.0771491	10.2621454	51
10	9.7380479	9.9227684	9.8152795	10.1847205	10.0772316	10.2619521	50
11	9.7382412	9.9226858	9.8155554	10.1844446	10.0773142	10.2617588	49
12	9.7384343	9.9226032	9.8158311	10.1841689	10.0773969	10.2615657	48
13	9.7386273	9.9225205	9.8161068	10.1838932	10.0774795	10.2613727	47
14	9.7388201	9.9224377	9.8163824	10.1836176	10.0775623	10.2611799	46
15	9.7390129	9.9223549	9.8166580	10.1833420	10.0776451	10.2609871	45
16	9.7392055	9.9222721	9.8169335	10.1830665	10.0777279	10.2607945	44
17	9.7393980	9.9221891	9.8172089	10.1827911	10.0778109	10.2606020	43
18	9.7395904	9.9221062	9.8174842	10.1825158	10.0778938	10.2604096	42
19	9.7397827	9.9220232	9.8177595	10.1822405	10.0779768	10.2602173	41
20	9.7399748	9.9219401	9.8180347	10.1819653	10.0780599	10.2600252	40
21	9.7401668	9.9218570	9.8183098	10.1816902	10.0781430	10.2598332	39
22	9.7403587	9.9217738	9.8185849	10.1814151	10.0782262	10.2596413	38
23	9.7405505	9.9216906	9.8188599	10.1811401	10.0783094	10.2594495	37
24	9.7407421	9.9216073	9.8191348	10.1808652	10.0783927	10.2592579	36
25	9.7409337	9.9215240	9.8194096	10.1805904	10.0784760	10.2590663	35
26	9.7411251	9.9214406	9.8196844	10.1803156	10.0785594	10.2588749	34
27	9.7413164	9.9213572	9.8199592	10.1800408	10.0786428	10.2586836	33
28	9.7415075	9.9212737	9.8202338	10.1797662	10.0787263	10.2584925	32
29	9.7416986	9.9211902	9.8205084	10.1794916	10.0788098	10.2583014	31
30	9.7418895	9.9211066	9.8207829	10.1792171	10.0788934	10.2581105	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

56 DEGREES.

A Table of the Latitude and Longitude of the Chiefest Places of the World.

The Coast of Scotland.

The Places Names.	*North Latitud.* D.	M.	*East Longit.* D.	M.
Berwick	55	[illegible]	2	30
Leith	56	3	2	09
Dondee	56	26	2	17
Aberdeen	57	22	2	29
Bafom Nafs	57	48	1	34
Cat Nafs	58	37	1	38
Iſles of Orkney	58	50	2	02
Fair Iſle	59	30	3	19
Shetland	60	22	2	54
Fair Head	58	43	2 W.	21
Iſland Lewes	58	30	2	48
Skey Iſland	57	40	2	3

The Sea-coast from the Lizard *to* Holy-Head.

The Places Names.	*North Latitud.* D.	M.	*East Longit.* D.	M.
Lands End	50	20	0	34
Gulfe	50	11	1	22
Scilly	50	7	1	21
7 Stones	50	18	1	16
Harty Point	51	10	0 E.	19
Londy	51	20	0 W.	3
Holms	51	26	1 E.	44
Briſtol	51	29	2	34
Glocefter	52	3	2	39
Caldy	51	53	0	10
Milford	52	5	0 W.	6
Ramza	52	12	0	38
Studwalls	53	12	0	04
Barzs	53	13	0 W.	16
Weſtcheſter	53	[illegible]	01 E.	04
Holy-Head.	[illegible]	44	0	26
Iſle of Man	54	25	0	36

The Sea-coast of Ireland

The Places Names.	*North Latitud.* D.	M.	*East Longit.* D.	M.
Lamby	53	44	1	46
Dublin	53	32	1	56

33 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N.Co-Secan.	
30	5519370	8338858	6518856	15108352	11992049	18118010	30
31	5521795	8337252	6623040	15098807	11994359	18110052	29
32	5524220	8335645	6627226	15089271	11996671	18102102	28
33	5526645	8334038	6631413	15079743	11998985	18094161	27
34	5529069	8332430	6635602	15070224	12001301	18086228	26
35	5531492	8330821	6639792	15060713	12003619	18078304	25
36	5533915	8329212	6643984	15051210	12005938	18070388	24
37	5536338	8327602	6648178	15041716	12008259	18062481	23
38	5538760	8325991	6652373	15032230	12010582	18054582	22
39	5541182	8324380	6656570	15022752	12012907	18046691	21
40	5543603	8322768	6660769	15013282	12015234	18038809	20
41	5546024	8321155	6664969	15003820	12017563	18030935	19
42	5548444	8319541	6669171	14994367	12019894	18023070	18
43	5550864	8317927	6673375	14984922	12022227	18015213	17
44	5553283	8316312	6677580	14975486	12024562	18007365	16
45	5555702	8314696	6681787	14966058	12026899	17999525	15
46	5558121	8313079	6685995	14956638	12029237	17991693	14
47	5560539	8311462	6690205	14947226	12031577	17983869	13
48	5562956	8309844	6694417	14937822	12033919	17976054	12
49	5565373	8308226	6698630	14928426	12036264	17968247	11
50	5567790	8306607	6702845	14919038	12038610	17960448	10
51	5570206	8304987	6707062	14909659	12040958	17952658	9
52	5572621	8303366	6711280	14900288	12043308	17944876	8
53	5575036	8301745	6715500	14890925	12045660	17937102	7
54	5577451	8300123	6719721	14881570	12048014	17929337	6
55	5579865	8298500	6723944	14872223	12050370	17921580	5
56	5582279	8296876	6728169	14862884	12052728	17913831	4
57	5584692	8295252	6732396	14853553	12055088	17906090	3
58	5587105	8293627	6736624	14844230	12057450	17898358	2
59	5589517	8292002	6740854	14834916	12059814	17890633	1
60	5591929	8290376	6745085	14825610	12062180	17882916	0
	N. Co-Sine.	N. Sine.	N.Co-Tang	N. Tangent.	N.Co Secant.	N. Secant.	M

56 DEGREES.

A Table of the Latitude and Longitude

The Places Names.	North Latitud. D.	North Latitud. M.	West Longit. D.	West Longit. M.	The Places Names.	North Latitud. D.	North Latitud. M.	West Longit. D.	West Longit. M.
Wexford	52	33	1	44	Loopas Head	52	44	5	41
Waterford	52	30	2	24	Gally Head	53	20	5	36
Corke	42	01	2	56	Galloway	43	40	5	16
Kingſail	51	52	3	08	Iſles of Arran	53	21	6	36
Old Head	51	40	3	14	Slages	54	27	6	21
Mizand Head	51	28	5	21	Iſles of Are	55	18	5	36
Cow and Calf	51	42	5	42	Fore Head	55	38	4	56
Skillukes	52	00	6	06	Fair Foreland	55	35	2	36
Blaskos	52	15	6	11					
Limrick	53	04	4	51					

33 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.7418895	9.9211066	9.8207829	10.1792171	10.0788934	10.2581105	30
31	9.7420803	9.9210229	9.8210574	10.1789426	10.0789771	10.2579197	29
32	9.7422710	9.9209393	9.8213317	10.1786683	10.0790607	10.2577290	28
33	9.7424616	9.9208555	9.8216060	10.1783940	10.0791445	10.2575384	27
34	9.7426520	9.9207717	9.8218803	10.1781197	10.0792283	10.2573480	26
35	9.7428423	9.9206878	9.8221545	10.1778455	10.0793122	10.2571577	25
36	9.7430325	9.9206039	9.8224286	10.1775714	10.0793961	10.2569675	24
37	9.7432226	9.9205200	9.8227026	10.1772974	10.0794800	10.2567774	23
38	9.7434126	9.9204360	9.8229766	10.1770234	10.0795640	10.2565874	22
39	9.7436024	9.9203519	9.8232505	10.1767495	10.0796481	10.2563976	21
40	9.7437921	9.9202678	9.8235244	10.1764756	10.0797322	10.2562079	20
41	9.7439817	9.9201836	9.8237981	10.1762019	10.0798164	10.2560183	19
42	9.7441712	9.9200994	9.8240719	10.1759281	10.0799006	10.2558288	18
43	9.7443606	9.9200151	9.8243455	10.1756545	10.0799849	10.2556394	17
44	9.7445498	9.9199308	9.8246191	10.1753809	10.0800692	10.2554502	16
45	9.7447390	9.9198464	9.8248926	10.1751074	10.0801536	10.2552610	15
45	9.7449280	9.9197619	9.8251660	10.1748340	10.0802381	10.2550720	14
47	9.7451169	9.9196775	9.8254394	10.1745606	10.0803225	10.2548831	13
48	9.7453056	9.9195929	9.8257127	10.1742873	10.0804071	10.2546944	12
49	9.7454943	9.9195083	9.8259860	10.1740140	10.0804917	10.2545057	11
50	9.7456828	9.9194237	9.8262592	10.1737408	10.0805763	10.2543172	10
51	9.7458712	9.9193390	9.8265323	10.1734677	10.0806610	10.2541288	9
52	9.7460595	9.9192542	9.8268053	10.1731947	10.0807458	10.2539405	8
53	9.7462477	9.9191694	9.8270783	10.1729217	10.0808306	10.2537523	7
54	9.7464358	9.9190845	9.8273513	10.1726487	10.0809155	10.2535642	6
55	9.7466237	9.9189996	9.8276241	10.1723759	10.0810004	10.2533763	5
56	9.7468115	9.9189146	9.8278969	10.1721031	10.0810854	10.2531885	4
57	9.7469992	9.9188296	9.8281696	10.1718304	10.0811704	10.2530008	3
58	9.7471868	9.9187145	9.8284423	10.1715577	10.0812555	10.2528132	2
59	9.7473743	9.9186594	9.8287149	10.1712851	10.0813406	10.2526257	1
60	9.7475617	9.9185742	9.8289874	10.1710125	10.0814258	10.2524383	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

56 DEGREES.

of the Chiefest Places of the World.

From Naze *of* Norway *to* Archangel.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.	The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
The Naze of Norway	58	00	0	26	Gripo	63	40	11	26
Stave Angor	58	57	9	44	Roſs Illes	67	1	13	30
Out Shers	59	7	8	30	Werro	67	38	13	52
Bomal	59	31	9	04	Lawſat	68	30	14	40
Harla Iſland	60	24	9	02	Zanham	70	28	18	32
Katts Naſs	61	54	8	06	Aſſumption	71	7	20	38
Swin	62	40	9	10	North Cape	71	22	22	6
Gallee	62	52	9	46	Skitanboro	70	56	24	2
					Iſland Kilding	68	54	26	16
					Cape Race	65	49	29	28

34 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secan.	
0	5591929	8290376	6745085	14825610	12062180	17882916	60
1	5594340	8288749	6749318	14816311	12064548	17875208	59
2	5596751	8287121	6753553	14807021	12066918	17867508	58
3	5599161	8285493	6757790	14797735	12069289	17859817	57
4	5601571	8283864	6762028	14788463	12071662	17852133	56
5	5603981	8282234	6766268	14779197	12074037	17844457	55
6	5606390	8280603	6770509	14769935	12076414	17836790	54
7	5608798	8278972	6774752	14760688	12078793	17829131	53
8	5611206	8277340	6778997	14751445	12081175	17821479	52
9	5613614	8275707	6783214	14742210	12083559	17813836	51
10	5616021	8274074	6787492	14732983	12085944	17806201	50
11	5618428	8272440	6791742	14723764	12088331	17798574	49
12	5620834	8270805	6795993	14714553	12090720	17790955	48
13	5623239	8269170	6800246	14705350	12093112	17783343	47
14	5625644	8267534	6804501	14696155	12095505	17775740	46
15	5628049	8265897	6808758	14686967	12097900	17768145	45
16	5630453	8264260	6813016	14677787	12100297	17760558	44
17	5632857	8262622	6817276	14668616	12102696	17752979	43
18	5635260	8260983	6821538	14659452	12105097	17745408	42
19	5637663	8259343	6825801	14650296	12107500	17737845	41
20	5640065	8257703	6830066	14641147	12109905	17730290	40
21	5642467	8256062	6834333	14632007	12112312	17722743	39
22	5644869	8254420	6838601	14622874	12114721	17715204	38
23	5647270	8252778	6842871	14613749	12117132	17707673	37
24	5649670	8251135	6847143	14604632	12119545	17700149	36
25	5652070	8249491	6851417	14595522	12121960	17692633	35
26	5654469	8247847	6855692	14586420	12124377	17685125	34
27	5656868	8246202	6859969	14577326	12126796	17677625	33
28	5659267	8244556	6864247	14568240	12129217	17670133	32
29	5661665	8242909	6868527	14559161	12131640	17662649	31
30	5664062	8241262	6872810	14550090	12134064	17655173	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

55 DEGREES.

34 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.7575617	9.9185742	9.8289874	10.1710126	10.0814258	10.2524383	60
1	9.7477489	9.9184890	9.8292599	10.1707401	10.0815110	10.2522511	59
2	9.7479360	9.9184037	9.8295323	10.1704677	10.0815963	10.2520640	58
3	9.7481230	9.9183183	9.8298047	10.1701953	10.0816817	10.2518770	57
4	9.7483099	9.9182329	9.8300769	10.1699231	10.0817671	10.2516901	56
5	9.7484967	9.9181475	9.8303492	10.1696508	10.0818525	10.2515033	55
6	9.7486833	9.9180620	9.8306213	10.1693787	10.0819380	10.2513167	54
7	9.7488698	9.9179764	9.8308934	10.1691066	10.0820236	10.2511302	53
8	9.7490562	9.9178908	9.8311654	10.1688346	10.0821092	10.2509438	52
9	9.7492425	9.9178051	9.8314374	10.1685626	10.0821949	10.2507575	51
10	9.7494287	9.9177194	9.8317093	10.1682907	10.0822806	10.2505713	50
11	9.7496148	9.9176336	9.8319811	10.1680189	10.0823664	10.2503852	49
12	9.7498007	9.9175478	9.8322529	10.1677471	10.0824522	10.2501993	48
13	9.7499866	9.9174619	9.8325246	10.1674754	10.0825381	10.2500134	47
14	9.7501723	9.9173760	9.8327963	10.1672037	10.0826240	10.2498277	46
15	9.7503579	9.9172900	9.8330679	10.1669321	10.0827100	10.2496421	45
16	9.7505434	9.9172040	9.8333394	10.1666606	10.0827960	10.2494565	44
17	9.7507287	9.9171179	9.8336109	10.1663891	10.0828821	10.2492713	43
18	9.7509140	9.9170317	9.8338823	10.1661177	10.0829683	10.2490860	42
19	9.7510991	9.9169455	9.8341536	10.1658464	10.0830545	10.2489009	41
20	9.7512842	9.9168593	9.8344249	10.1655751	10.0831407	10.2487158	40
21	9.7514691	9.9167730	9.8346961	10.1653039	10.0832270	10.2485309	39
22	9.7516538	9.9166866	9.8349673	10.1650327	10.0833134	10.2483462	38
23	9.7518385	9.9166002	9.8352384	10.1647616	10.0833998	10.2481615	37
24	9.7520231	9.9165137	9.8355094	10.1644906	10.0834863	10.2479769	36
25	9.7522075	9.9164272	9.8357804	10.1642196	10.0835728	10.2477925	35
26	9.7523919	9.9163406	9.8360513	10.1639487	10.0836594	10.2476081	34
27	9.7525761	9.9162539	9.8363221	10.1636779	10.0837461	10.2474239	33
28	9.7527602	9.9161673	9.8365929	10.1634071	10.0838327	10.2472398	32
29	9.7529442	9.9160805	9.8368636	10.1631364	10.0839195	10.2470558	31
30	9.7531280	9.9159937	9.8371343	10.1628657	10.0840063	10.2468720	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

55 DEGREES.

A Table of the Latitude and Longitude *of the Chiefeſt Places of the World.*

The Places Names.	*North Latitud.* D.	M.	*Eaſt Longit.* D.	M.
Cape Gallant	67	11	28	56
Cape Grace	65	17	28	54
Fox Naze	64	12	26	31
Archangel	63	22	26	46
The Coaſt of Greenland.				
Cherri Iſland	74	34	20	3[illegible]
Hope Iſland	76	13	23	16
Hopeleſs Iſles	77	00	22	54

The Places Names.	*North Latitud.* D.	M.	*Eaſt Longit.* D.	M.
Nageo Point	[illegible]	10	23	38
Duckus Cove	77	45	22	54
Cape Blande	78	25	23	26
Helis Sound	79	27	24	19
Point Lookout	76	25	20	18
Ball Sound	[illegible]	34	20	00
Foe Sound	78	38	20	3
Horn Sound	77	7	20	45
Deer Sound	79	15	19	55
Black point	78	32	18	34

The Places Names.	*North Latitud.* D.	M.	*Eaſt Longit.* D.	M.
Cape Cold	79	00	17	56
Fair Foreland	79	15	19	29
The Sea-coaſt in the Sound.				
Lizol	57	35	14	09
Anall	57	0[illegible]	14	41
Elſen-nore	56	40	15	21
Copenhagen	56	17	15	18
Mooan	55	41	15	20

The Places Names.	*North Latitud.* D.	M.	*Eaſt Longit.* D.	M.
Witmond	55	20	16	32
Iſmond	55	20	16	41
Burnholm	56	00	17	40
Erthholm	56	10	17	58
Gathe ſand	56	15	22	03
Farro Sound	58	48	21	53
Gotland	58	20	21	22
Heda	55	53	21	29
Dormamel	56	55	23	44
Dines Naſs	58	22	23	55

34 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	5664062	8241262	6872810	14550090	12134064	17655173	30
31	5666459	8239614	6877094	14541027	12136491	17647703	29
32	5668856	8237965	6881379	14531971	12138920	17640243	28
33	5671252	8236316	6885666	14522923	12141351	17632791	27
34	5673648	8234666	6889955	14513883	12143783	17625345	26
35	5676043	8233015	6894246	14504850	12146218	17617908	25
36	5678437	8231364	6898538	14495825	12148655	17610478	24
37	5680831	8229712	6902832	14486808	12151094	17603056	23
38	5683225	8228059	6907128	14477798	12153535	17595642	22
39	5685618	8226405	6911425	14468796	12155978	17588236	21
40	5688011	8224751	6915724	14459801	12158423	17580837	20
41	5690403	8223096	6920025	14450814	12160870	17573446	19
42	5692795	8221440	6924328	14441834	12163319	17566063	18
43	5695186	8219784	6928633	14432862	12165770	17558687	17
44	5697577	8218127	6932939	14423897	12168223	17551319	16
45	5699968	8216469	6937247	14414940	12170678	17543959	15
46	5702358	8214811	6941557	14405991	12173135	17536607	14
47	5704747	8213152	6945868	14397049	12175594	17529262	13
48	5707136	8211492	6950181	14388114	12178055	17521924	12
49	5709524	8209831	6954496	14379187	12180518	17514594	11
50	5711912	8208170	6958813	14370268	12182983	17507273	10
51	5714299	8206508	6963131	14361356	12185450	17499958	9
52	5716686	8204845	6967451	14352451	12187919	17492651	8
53	5719073	8203183	6971773	14343554	12190390	17485352	7
54	5721459	8201519	6976097	14334664	12192864	17478060	6
55	5723844	8199854	6980422	14325781	12195339	17470776	5
56	5726229	8198189	6984749	14316906	12197816	17463499	4
57	5728614	8196523	6989078	14308039	12200296	17456230	3
58	5730998	8194856	6993409	14299178	12202777	17448969	2
59	5733381	8193189	6997741	14290326	12205260	17441715	1
60	5735764	8191521	7002075	14281480	12207746	17434468	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

55 DEGREES.

34 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.7531280	9.9159937	9.8371343	10.1628657	10.0840063	10.2468720	30
31	9.7533118	9.9159069	9.8374049	10.1625951	10.0840931	10.2466882	29
32	9.7534954	9.9158200	9.8376755	10.1623245	10.0841800	10.2465046	28
33	9.7536790	9.9157330	9.8379460	10.1620540	10.0842670	10.2463210	27
34	9.7538624	9.9156460	9.8382164	10.1617836	10.0843540	10.2461376	26
35	9.7540457	9.9155589	9.8384867	10.1615133	10.0844412	10.2459543	25
36	9.7542288	9.9154718	9.8387571	10.1612429	10.0845282	10.2457712	24
37	9.7544119	9.9153846	9.8390273	10.1609727	10.0846154	10.2455881	23
38	9.7545949	9.9152974	9.8392975	10.1607025	10.0847026	10.2454051	22
39	9.7547777	9.9152101	9.8395676	10.1604324	10.0847899	10.2452223	21
40	9.7549604	9.9151228	9.8398377	10.1601623	10.0848772	10.2450396	20
41	9.7551431	9.9150354	9.8401077	10.1598923	10.0849646	10.2448569	19
42	9.7553256	9.9149479	9.8403776	10.1596224	10.0850521	10.2446744	18
43	9.7555080	9.9148604	9.8406475	10.1593525	10.0851396	10.2444920	17
44	9.7556902	9.9147729	9.8409174	10.1590826	10.0852271	10.2443098	16
45	9.7558724	9.9146852	9.8411871	10.1588129	10.0853148	10.2441275	15
46	9.7560544	9.9145975	9.8414569	10.1585431	10.0854024	10.2439456	14
47	9.7562364	9.9145099	9.8417265	10.1582735	10.0854901	10.2437635	13
48	9.7564182	9.9144221	9.8419961	10.1580039	10.0855779	10.2435818	12
49	9.7565999	9.9143342	9.8422657	10.1577343	10.0856658	10.2434001	11
50	9.7567815	9.9142464	9.8425351	10.1574649	10.0857536	10.2432185	10
51	9.7569630	9.9141584	9.8428046	10.1571954	10.0858416	10.2430370	9
52	9.7571444	9.9140704	9.8430739	10.1569261	10.0859296	10.2428556	8
53	9.7573256	9.9139824	9.8433432	10.1566568	10.0860176	10.2426744	7
54	9.7575068	9.9138943	9.8436125	10.1563875	10.0861057	10.2424932	6
55	9.7576878	9.9138061	9.8438817	10.1561183	10.0861939	10.2423122	5
56	9.7578687	9.9137179	9.8441508	10.1558492	10.0862821	10.2421313	4
57	9.7580495	9.9136296	9.8444199	10.1555801	10.0863704	10.2419505	3
58	9.7582302	9.9135413	9.8446889	10.1553111	10.0864587	10.2417698	2
59	9.7584108	9.9134530	9.8449579	10.1550421	10.0865471	10.2415892	1
60	9.7585913	9.9133645	9.8452268	10.1547732	10.0866355	10.2414087	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

55 DEGREES.

A Table of the Latitude and Longitude of the Chiefest Places of the World.

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
Riga	57	50	26	25
Runen	58	38	25	14
Parun	58	52	26	54
Shorham	58	58	26	30
Wile	59	06	25	06
Ardenbro	59	05	24	06
Dagarat	59	41	23	55
Ogſholm	59	58	24	32
Norgin	60	10	25	14
Eaſt Rand	60	12	28	41
Wibro	61	16	30	00
Wakato	61	16	29	42
Patting	61	00	28	45
Burga	61	02	27	14
Roſtbrugh	61	03	25	04
Abbo	61	08	23	28
Buſhoers	60	09	21	54
Stockholm	58	49	20	06
Frouenboro	58	48	18	16
Stickholm	58	23	18	24
Yaffro	58	10	18	58
Fuland	57	42	19	12
Chiping	56	53	18	27
Faſtinboro	56	02	15	49
Scarlet Iſland	56	40	16	02
Elſinbro	56	46	16	00
Cape Cole	57	00	15	36
Nading	57	53	15	04
Holm Sound	59	08	13	44
Mordo	58	37	12	02
Walle Sound	58	25	11	40
Long Sound	59	07	12	54

The Sea-coaſt of Flanders *and* Holland, *from* Callis *to the* Scaw.

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
Dunkirk	51	18	07	49
Oſtend	51	30	08	29
Sluice	51	38	09	11
Zealand	51	48	09	05

35 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	5735764	8191521	7002075	14281480	12207746	17434468	60
1	5738147	8189852	7006411	14272642	12210233	17427229	59
2	5740529	8188182	7010749	14263811	12212723	17419997	58
3	5742911	8186512	7015089	14254987	12215215	17412773	57
4	5745292	8184841	7019430	14246171	12217708	17405556	56
5	5747672	8183169	7023773	14237362	12220204	17398347	55
6	5750052	8181497	7028118	14228561	12222702	17391145	54
7	5752432	8179824	7032465	14219766	12225202	17383951	53
8	5754811	8178150	7036813	14210979	12227703	17376764	52
9	5757190	8176476	7041163	14202200	12230207	17369585	51
10	5759568	8174801	7045515	14193422	12232713	17362413	50
11	5761946	8173125	7049869	14184662	12235221	17355247	49
12	5764323	8171449	7054224	14175904	12237732	17348090	48
13	5766700	8169772	7058581	14167152	12240244	17340941	47
14	5769076	8168094	7062940	14158409	12242758	17333798	46
15	5771452	8166415	7067301	14149673	12245274	17326663	45
16	5773827	8164736	7071664	14140943	12247793	17319535	44
17	5776202	8163056	7076029	14132221	12250313	17312414	43
18	5778576	8161376	7080395	14123506	12252836	17305301	42
19	5780950	8159695	7084763	14114799	12255361	17298195	41
20	5783323	8158013	7089133	14106098	12257887	17291096	40
21	5785696	8156330	7093505	14097405	12260416	17284005	39
22	5788068	8154647	7097878	14088718	12262947	17276921	38
23	5790440	8152963	7102253	14080039	12265480	17269844	37
24	5792812	8151278	7106630	14071367	12268015	17262774	36
25	5795183	8149593	7111009	14062702	12270552	17255712	35
26	5797553	8147906	7115390	14054044	12273091	17248657	34
27	5799923	8146219	7119773	14045393	12275633	17241609	33
28	5802292	8144532	7124157	14036749	12278176	17234568	32
29	5804661	8142844	7128543	14028113	12280721	17227534	31
30	5807030	8141155	7132931	14019483	12283269	17220508	30
	N. Co-Sine	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

54 DEGREES.

35 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.7585913	9.9133645	9.8452268	10.1547732	10.0866355	10.2414087	60
1	9.7587717	9.9132760	9.8454956	10.1545044	10.0867240	10.2412283	59
2	9.7589519	9.9131875	9.8457644	10.1542356	10.0868125	10.2410481	58
3	9.7591321	9.9130989	9.8460332	10.1539668	10.0869011	10.2408679	57
4	9.7593121	9.9130102	9.8463018	10.1536982	10.0869898	10.2406879	56
5	9.7594920	9.9129215	9.8465705	10.1534295	10.0870785	10.2405080	55
6	9.7596718	9.9128328	9.8468390	10.1531610	10.0871672	10.2403282	54
7	9.7598515	9.9127440	9.8471075	10.1528925	10.0872560	10.2401485	53
8	9.7600311	9.9126551	9.8473760	10.1526240	10.0873449	10.2399689	52
9	9.7602106	9.9125662	9.8476444	10.1523556	10.0874338	10.2397894	51
10	9.7603899	9.9124772	9.8479127	10.1520873	10.0875228	10.2396101	50
11	9.7605692	9.9123882	9.8481810	10.1518190	10.0876118	10.2394308	49
12	9.7607483	9.9122991	9.8484492	10.1515508	10.0877009	10.2392517	48
13	9.7609274	9.9122099	9.8487174	10.1512826	10.0877901	10.2390726	47
14	9.7611063	9.9121207	9.8489855	10.1510145	10.0878793	10.2388937	46
15	9.7612851	9.9120315	9.8492536	10.1507464	10.0879685	10.2387149	45
16	9.7614638	9.9119422	9.8495216	10.1504784	10.0880578	10.2385362	44
17	9.7616424	9.9118528	9.8497896	10.1502104	10.0881472	10.2383576	43
18	9.7618208	9.9117634	9.8500575	10.1499424	10.0882366	10.2381792	42
19	9.7619992	9.9116739	9.8503253	10.1496747	10.0883261	10.2380008	41
20	9.7621775	9.9115844	9.8505931	10.1494069	10.0884156	10.2378225	40
21	9.7623556	9.9114948	9.8508608	10.1491392	10.0885052	10.2376444	39
22	9.7625337	9.9114051	9.8511285	10.1488715	10.0885949	10.2374663	38
23	9.7627116	9.9113155	9.8513961	10.1486039	10.0886845	10.2372884	37
24	9.7628894	9.9112257	9.8516637	10.1483363	10.0887743	10.2371106	36
25	9.7630671	9.9111359	9.8519312	10.1480688	10.0888641	10.2369329	35
26	9.7632447	9.9110460	9.8521987	10.1478013	10.0889540	10.2367553	34
27	9.7634222	9.9109561	9.8524661	10.1475339	10.0890439	10.2365778	33
28	9.7635996	9.9108661	9.8527335	10.1472665	10.0891339	10.2364004	32
29	9.7637769	9.9107761	9.8530008	10.1469992	10.0892239	10.2362231	31
30	9.7639540	9.9106860	9.8532680	10.1467320	10.0893140	10.2360460	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

54 DEGREES.

A Table of the Latitude and Longitude of the Chiefest Places of the World.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
The Brill	52	08	09	08
Antwerp	51	37	09	46
Rotterdam	52	05	09	48
Amſterdam	52	40	10	01
The Taſſel	53	20	10	16
The Uly	53	30	10	12
Skelling	53	35	10	14
Amaland	53	40	10	16
Embden	53	44	11	00
Breme	53	50	12	26
Hambrough	54	04	13	26
Holikeland	54	30		
Stonar	55	17	12	08
The Scaw	57	52	13	51

The Sea-coaſt of France, Spain, *and* Portugal, *from* Callis *to* Cales.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Callis	51	13	07	16
Deip	50	15	06	39
St. Vallari	50	08	05	29
Seine Head	50	04	05	28
Roan	49	46	05	54
Cape Barſlaw	49	57	04	32
Cape Hogue	50	04	03	52
Alderney	50	02	03	37
Caskats	50	07	03	09
Ornay	49	48	03	05
Garnſey	49	43	02	49
Sark	49	37	03	09
Jerſey	49	30	03	24
Boſſin	49	19	03	42
Coſol	49	05	03	44
St. Mallowes	48	45	03	39
Satta Iſles	49	07	02	02
Morlaux	48	54	01	39
Iſland *of* Baſſe	49	01	01	27
Uſhant	48	48	00	05
Conqueſt	48	45	00	19
Breſt	48	35	00	50

35 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	5807030	8141155	7132931	14019483	12283269	17220508	30
31	5809398	8139465	7137321	14010860	12285819	17213489	29
32	5811765	8137775	7141713	14002245	12288371	17206477	28
33	5814132	8136084	7146116	13993636	12290925	17199472	27
34	5816498	8134393	7150501	13985034	12293481	17192475	26
35	5818864	8132701	7154898	13976440	12296039	17185484	25
36	5821230	8131008	7159297	13967552	12298599	17178501	24
37	5823595	8129314	7163698	13959272	12301161	17171525	23
38	5825959	8127620	7168101	13950698	12303725	17164556	22
39	5828323	8125925	7172505	13942131	12306292	17157594	21
40	5830687	8124229	7176911	13933571	12308861	17150639	20
41	5833050	8122532	7181319	13925018	12311432	17143691	19
42	5835412	8120835	7185729	13916473	12314005	17136750	18
43	5837774	8119137	7190141	13907934	12316580	17129817	17
44	5840136	8117439	7194555	13899401	12319157	17122890	16
45	5842497	8115740	7198970	13890876	12321736	17115970	15
46	5844857	8114040	7203387	13882358	12324317	17109058	14
47	5847217	8112339	7207806	13873846	12326900	17102152	13
48	5849577	8110638	7212227	13865342	12329486	17095254	12
49	5851936	8108936	7216650	13856844	12332074	17088362	11
50	5854294	8107233	7221075	13848353	12334664	17081478	10
51	5856652	8105530	7225502	13839869	12337256	17074600	9
52	5859010	8103826	7229931	13831392	12339850	17067730	8
53	5861367	8102121	7234361	13822922	12342446	17060866	7
54	5863724	8100416	7238793	13814458	12345044	17054010	6
55	5866080	8098710	7243227	13806001	12347645	17047160	5
56	5868435	8097[illegible]	7247663	13797551	12350248	17040318	4
57	5870790	8095296	7252101	13789108	1235285[illegible]	17033482	3
58	5873145	8093588	7256541	13780672	12355459	17026653	2
59	5875499	8091879	7260983	13772242	12358068	17019831	1
60	5877853	8090170	7265426	13763819	12360680	17013016	0
	N. Co-Sine	N. Sine.	N.Co-Tang	N. Tangent.	N.Co-Secant.	N. Secant.	M

54 DEGREES.

A Table of the Latitude and Longitude

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.	The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Camarita Bay	48	25	00	56	Piller	47	04	03	22
Seames	48	04	00	E. 23	Ilſs	46	44	03	20
Paiker	48	00	00	W. 01	Barges	46	30	03	54
Pennes, *or* Pennmark	47	35	01	10	*St.* Martins	46	16	04	29
Glannats	47	33	01	34	Olloron	45	58	04	30
Groy	47	35	01	54	Mamoſin	45	49	04	34
Belle Iſle	47	19	02	14	Toppar	45	36	03	29
Cardinals	47	27	02	24	Rochel	46	17	04	54
Radon	47	55	03	33	Sherant	46	00	04	56
Nants	47	45	04	15	Rochfort	45	28	05	19

35 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.7639540	9.9106860	9.8532680	10.1467320	10.0893140	10.2360460	30
31	9.7641311	9.9105959	9.8535352	10.1464648	10.0894041	10.2358689	29
32	9.7643080	9.9105057	9.8538023	10.1461977	10.0894943	10.2356920	28
33	9.7644849	9.9104155	9.8540694	10.1459306	10.0895846	10.2355151	27
34	9.7646616	9.9103251	9.8543365	10.1456635	10.0896749	10.2353384	26
35	9.7648382	9.9102348	9.8546034	10.1453966	10.0897652	10.2351618	25
36	9.7650147	9.9101444	9.8548704	10.1451296	10.0898556	10.2349853	24
37	9.7651911	9.9100539	9.8551372	10.1448628	10.0899461	10.2348089	23
38	9.7653674	9.9099634	9.8554041	10.1445959	10.0900366	10.2346326	22
39	9.7655436	9.9098728	9.8556708	10.1443292	10.0901272	10.2344564	21
40	9.7657197	9.9097821	9.8559376	10.1440624	10.0902179	10.2342803	20
41	9.7658957	9.9096915	9.8562042	10.1437958	10.0903085	10.2341043	19
42	9.7660715	9.9096007	9.8564708	10.1435292	10.0903993	10.2339285	18
43	9.7662473	9.9095099	9.8567374	10.1432626	10.0904901	10.2337527	17
44	9.7664229	9.9094190	9.8570039	10.1429961	10.0905810	10.2335771	16
45	9.7665985	9.9093281	9.8572704	10.1427296	10.0906719	10.2334015	15
46	9.7667739	9.9092371	9.8575368	10.1424632	10.0907629	10.2332261	14
47	9.7669492	9.9091461	9.8578031	10.1421969	10.0908539	10.2330508	13
48	9.7671244	9.9090550	9.8580694	10.1419306	10.0909450	10.2328756	12
49	9.7672996	9.9089639	9.8583357	10.1416643	10.0910361	10.2327004	11
50	9.7674746	9.9088727	9.8586019	10.1413981	10.0911273	10.2325254	10
51	9.7676494	9.9087814	9.8588680	10.1411320	10.0912186	10.2323506	9
52	9.7678242	9.9086901	9.8591341	10.1408659	10.0913099	10.2321758	8
53	9.7679989	9.9085988	9.8594002	10.1405998	10.0914012	10.2320011	7
54	9.7681735	9.9085073	9.8596661	10.1403339	10.0914927	10.2318265	6
55	9.7683480	9.9084159	9.8599321	10.1400679	10.0915841	10.2316520	5
56	9.7685223	9.9083243	9.8601980	10.1398020	10.0916757	10.2314777	4
57	9.7686966	9.9082327	9.8604638	10.1395362	10.0917673	10.2313034	3
58	9.7688707	9.9081411	9.8607296	10.1392704	10.0918589	10.2311293	2
59	9.7690448	9.9080494	9.8609954	10.1390046	10.0919506	10.2309553	1
60	9.7692187	9.9079576	9.8612610	10.1387390	10.0920424	10.2307813	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

54 DEGREES.

of the Chiefest Places of the World.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.	The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Burdeaux	45	10	05	E. 44	Iſles *of* Boyon	42	22	02	00
St. Sebaſtian	43	40	04	19	Burlings	39	43	02	28
Bilboe	43	41	03	20	Rock *of* Lisbone	39	00	02	04
St. Andrea	43	43	02	36	Lisbone	39	08	01	06
Lyons	43	49	02	06	Cape *St.* Vincent	37	02	01	18
Cape Pines	44	04	00	E. 52	Cape *St.* Maria	36	52	00	W. 24
Cape Ortegal	44	08	00	06	Cales, *or* Cadiz	36	32	01	24
Sazarga	43	38	01	52					
Cape Corian	43	21	02	56					
Cape Finiſterre	43	10	02	55					

36 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	5877853	8090170	7265426	13763819	12360680	17013016	60
1	5880206	8088460	7269871	13755403	12363294	17006208	59
2	5882558	8086749	7274318	13746994	12365909	16999407	58
3	5884910	8085037	7278767	13738591	12368526	16992612	57
4	5887262	8083325	7283218	13730195	12371148	16985825	56
5	5889613	8081612	7287671	13721805	12373768	16979044	55
6	5891964	8079899	7292126	13713423	12376393	16972271	54
7	5894314	8078185	7296582	13705047	12379019	16965504	53
8	5896663	8076470	7301040	13696675	12381647	16958743	52
9	5899012	8074754	7305501	13688315	12384278	16951990	51
10	5901361	8073038	7309963	13679959	12386911	16945244	50
11	5903709	8071321	7314427	13671610	12389546	16938504	49
12	5906057	8069603	7318894	13663267	12392183	16931771	48
13	5908404	8067885	7323362	13654931	12394822	16925045	47
14	5910750	8066166	7327831	13646602	12397464	16918326	46
15	5913096	8064446	7332303	13638279	12400108	16911613	45
16	5915442	8062726	7336777	13629963	12402754	16904907	44
17	5917787	8061005	7341253	13621653	12405402	16898208	43
18	5920132	8059283	7345730	13613350	12408052	16891516	42
19	5922476	8057560	7350210	13605054	12410704	16884830	41
20	5924819	8055837	7354691	13596764	12413359	16878151	40
21	5927162	8054113	7359174	13588481	12416016	16871479	39
22	5929505	8052389	7363660	13580204	12418675	16864814	38
23	5931847	8050664	7368147	13571934	12421336	16858155	37
24	5934189	8048938	7372636	13563670	12423999	16851503	36
25	5936530	8047211	7377127	13555413	12426665	16844857	35
26	5938871	8045484	7381620	13547162	12429333	16838218	34
27	5941211	8043756	7386115	13538918	12432003	16831586	33
28	5943550	8042028	7390611	13530680	12434675	16824961	32
29	5945889	8040299	7395110	13522449	12437349	16818342	31
30	5948228	8038569	7399611	13514224	12440026	16811730	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

53 DEGREES.

36 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.7692187	9.9079576	9.8612610	10.1387390	10.0920424	10.2307813	60
1	9.7693925	9.9078658	9.8615267	10.1384733	10.0921342	10.2306075	59
2	9.7695662	9.9077740	9.8617923	10.1382077	10.0922260	10.2304338	58
3	9.7697398	9.9076820	9.8620578	10.1379422	10.0923180	10.2302602	57
4	9.7699134	9.9075901	9.8623233	10.1376767	10.0924099	10.2300866	56
5	9.7700868	9.9074980	9.8625887	10.1374113	10.0925020	10.2299132	55
6	9.7702601	9.9074059	9.8628541	10.1371459	10.0925941	10.2297399	54
7	9.7704332	9.9073138	9.8631195	10.1368805	10.0926862	10.2295668	53
8	9.7706063	9.9072216	9.8633848	10.1366152	10.0927784	10.2293937	52
9	9.7707793	9.9071293	9.8636500	10.1363500	10.0928707	10.2292207	51
10	9.7709522	9.9070370	9.8639152	10.1360848	10.0929630	10.2290478	50
11	9.7711249	9.9069445	9.8641803	10.1358197	10.0930554	10.2288751	49
12	9.7712976	9.9068522	9.8644454	10.1355546	10.0931478	10.2287024	48
13	9.7714702	9.9067597	9.8647105	10.1352895	10.0932403	10.2285298	47
14	9.7716426	9.9066671	9.8649755	10.1350245	10.0933329	10.2283574	46
15	9.7718150	9.9065745	9.8652404	10.1347596	10.0934255	10.2281850	45
16	9.7719872	9.9064819	9.8655053	10.1344947	10.0935181	10.2280128	44
17	9.7721593	9.9063892	9.8657702	10.1342298	10.0936108	10.2278407	43
18	9.7723314	9.9062964	9.8660350	10.1339650	10.0937036	10.2276686	42
19	9.7725033	9.9062036	9.8662997	10.1337003	10.0937964	10.2274967	41
20	9.7726751	9.9061107	9.8665644	10.1334356	10.0938893	10.2273249	40
21	9.7728468	9.9060177	9.8668291	10.1331709	10.0939823	10.2271532	39
22	9.7730185	9.9059247	9.8670937	10.1329063	10.0940753	10.2269815	38
23	9.7731900	9.9058317	9.8673583	10.1326417	10.0941683	10.2268100	37
24	9.7733614	9.9057386	9.8676228	10.1323772	10.0942614	10.2266386	36
25	9.7735327	9.9056454	9.8678873	10.1321127	10.0943546	10.2264673	35
26	9.7737039	9.9055522	9.8681517	10.1318483	10.0944478	10.2262961	34
27	9.7738749	9.9054589	9.8684160	10.1315840	10.0945411	10.2261251	33
28	9.7740459	9.9053656	9.8686804	10.1313196	10.0946344	10.2259541	32
29	9.7742168	9.9052722	9.8689446	10.1310554	10.0947278	10.2257832	31
30	9.7743876	9.9051787	9.8692089	10.1307911	10.0948213	10.2256124	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

53 DEGREES.

A Table of the Latitude and Longitude of the Chiefest Places of the World.

From Giblitor to Cape Fistria.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Giblitor, or Gibralter	36	40	02	06
Malaga	36	45	03	07
Castle Ferro	36	49	03	33
Cape de Gata	36	47	05	24
Cape de Palos	37	28	07	11
Allagant	38	20	07	14
Cape Martin	38	46	08	20
Cape Pallomallo	40	10	08	39
Cape de Creus	41	41	11	18
Marsilia	43	12	12	44
Tollon	43	00	14	04
Cape Larci	42	58	14	38
Cape Melli	43	51	15	37
Legorn	43	28	19	03
Civita vecha	41	46	20	24
Rome	41	50	21	09
Neapolis	41	08	22	51
Sallarne	40	51	23	32
Pollicastro	40	08	24	02
Cape Sparti-vento	37	45	24	16
Cape Colunne	38	56	25	40
Gallipoli	40	08	27	04
Cape St. Massa	39	52	26	53
Angollo	41	31	27	02
Ancona	43	25	24	29
Giavocha	44	19	21	26
Gorro	44	57	21	35
Venetia	45	37	22	45
Cape Fistria	44	40	24	10

The Sea-coasts on the Main, from Tangeir to Joppa in the Straits.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Wadallo in the Straits	34	57	03	13
Ballis	34	57	03	48
Oran	35	46	07	59
Tenes	36	30	09	18

36 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	5948228	8038569	7399611	13514224	12440026	16811730	30
31	5950566	8036838	7404114	13506006	12442705	16805124	29
32	5952903	8035107	7408618	13497794	12445386	16798525	28
33	5955240	8033375	7413124	13489589	12448069	16791933	27
34	5957577	8031642	7417633	13481390	12450754	16785347	26
35	5959913	8029909	7422143	13473197	12453442	16778768	25
36	5962249	8028175	7426655	13465011	12456131	16772195	24
37	5964584	8026440	7431170	13456832	12458823	16765629	23
38	5966918	8024705	7435686	13448658	12461518	16759070	22
39	5969252	8022969	7440204	13440492	12464214	16752517	21
40	5971586	8021232	7444724	13432331	12466913	16745970	20
41	5973919	8019494	7449246	13424177	12469614	16739430	19
42	5976251	8017756	7453770	13416029	12472317	16732897	18
43	5978583	8016017	7458296	13407888	12475022	16726370	17
44	5980915	8014278	7462824	13399753	12477730	16719850	16
45	5983246	8012538	7467354	13391624	12480440	16713336	15
46	5985575	8010797	7471886	13383502	12483152	16706828	14
47	5987906	8009056	7476420	13375386	12485866	16700328	13
48	5990236	8007314	7480956	13367276	12488583	16693833	12
49	5992565	8005571	7485494	13359172	12491302	16687345	11
50	5994893	8003827	7490033	13351075	12494023	16680864	10
51	5997221	8002083	7494575	13342984	12496746	16674389	9
52	5999549	8000338	7499119	13334900	12499471	16667920	8
53	6001876	7998593	7503665	13326822	12502199	16661458	7
54	6004202	7996847	7508212	13318749	12504929	16655002	6
55	6006528	7995100	7512762	13310684	12507661	16648552	5
56	6008853	7993352	7517314	13302624	12510396	16642109	4
57	6011178	7991604	7521867	13294571	12513133	16635673	3
58	6013503	7989855	7526423	13286524	12515872	16629243	2
59	6015827	7988105	7530981	13278483	12518613	16622819	1
60	6018150	7986355	7535540	13270448	12521357	16616401	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

53 DEGREES.

A Table of the Latitude and Longitude

The Places Names.	North Latitud D.	M.	East Longit. D.	M.
Serfally	36	40	09	48
Argier	36	40	10	54
Tadallis	36	48	11	25
Ragin	36	50	11	44
Gion	36	50	13	30
Gigary	37	03	14	26
Cholla	37	09	15	14
Stora	37	09	15	44
Cape Bone	37	19	16	44
Bozarat	37	30	17	50

The Places Names.	North Latitud D.	M.	East Longit. D.	M.
Tunis	36	50	17	24
Cape Beun	37	05	18	11
Suffa	36	02	18	07
Britto	35	23	18	41
Cherunne	34	56	18	36
Cape Mizarata	32	18	24	00
Cape de Solona	31	01	25	49
Cape Ruffutta	32	58	29	26
Cape Roattini	32	18	32	04
Alexandria	30	40	41	28

36 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.7743876	9.9051785	9.8692089	10.1307911	10.0948213	10.2256124	30
31	9.7745583	9.9050852	9.8694731	10.1305269	10.0949148	10.2254417	29
32	9.7747288	9.9049916	9.8697372	10.1302628	10.0950084	10.2252712	28
33	9.7748993	9.9048980	9.8700013	10.1299987	10.0951020	10.2251007	27
34	9.7750697	9.9048043	9.8702653	10.1297347	10.0951957	10.2249303	26
35	9.7752399	9.9047106	9.8705293	10.1294707	10.0952894	10.2247601	25
36	9.7754101	9.9046168	9.8707933	10.1292067	10.0953832	10.2245899	24
37	9.7755801	9.9045230	9.8710572	10.1289428	10.0954770	10.2244199	23
38	9.7757501	9.9044291	9.8713210	10.1286790	10.0955709	10.2242499	22
39	9.7759199	9.9043351	9.8715848	10.1284152	10.0956649	10.2240801	21
40	9.7760897	9.9042411	9.8718486	10.1281514	10.0957589	10.2239103	20
41	9.7762593	9.9041470	9.8721123	10.1278877	10.0958530	10.2237407	19
42	9.7764289	9.9040529	9.8723760	10.1276240	10.0959471	10.2235711	18
43	9.7765983	9.9039587	9.8726396	10.1273604	10.0960413	10.2234017	17
44	9.7767676	9.9038644	9.8729032	10.1270968	10.0961356	10.2232324	16
45	9.7769369	9.9037701	9.8731668	10.1268332	10.0962299	10.2230631	15
46	9.7771060	9.9036757	9.8734302	10.1265698	10.0963243	10.2228940	14
47	9.7772750	9.9035813	9.8736937	10.1263063	10.0964187	10.2227250	13
48	9.7774439	9.9034868	9.8739571	10.1260429	10.0965132	10.2225561	12
49	9.7776128	9.9033923	9.8742204	10.1257796	10.0966077	10.2223872	11
50	9.7777815	9.9032977	9.8744838	10.1255162	10.0967023	10.2222185	10
51	9.7779501	9.9032031	9.8747470	10.1252530	10.0967969	10.2220499	9
52	9.7781186	9.9031084	9.8750102	10.1249898	10.0968916	10.2218814	8
53	9.7782870	9.9030136	9.8752734	10.1247266	10.0969864	10.2217130	7
54	9.7784553	9.9029188	9.8755365	10.1244635	10.0970812	10.2215447	6
55	9.7786235	9.9028239	9.8757996	10.1242004	10.0971761	10.2213756	5
56	9.7787916	9.9027289	9.8760627	10.1239373	10.0972711	10.2212084	4
57	9.7789596	9.9026339	9.8763257	10.1236743	10.0973661	10.2210404	3
58	9.7791275	9.9025389	9.8765886	10.1234114	10.0974611	10.2208725	2
59	9.7792953	9.9024438	9.8768515	10.1231485	10.0975562	10.2207047	1
60	9.7794630	9.9023486	9.8771144	10.1228856	10.0976514	10.2205370	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

53 DEGREES.

of the Chiefest Places of the World.

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
Michallat	30	30	41	55
Cairo	30	35	41	44
Joppa	31	42	43	39

The Coast from Antiochia *to* Sagua *in the* Straits.

From Antiochia *to* Sagua	34	54	46	26
Cape Pellopolla	35	35	44	01
Cape Seridioni	35	55	41	24

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
Cape Decexman	36	16	36	44
Cape Babarnau	37	58	36	22
Land Miri	39	12	37	05
Incommodio	40	26	40	39
Constantinople	40	56	40	33
Gallippolo	40	20	37	59
Cape Degriffa	40	12	37	11
Cape Pimra	40	26	32	23
Cape St. George	39	28	32	10
Cape Collo	37	40	32	35

37 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N.Co-Secant.	
0	6018150	7986355	7535540	13270448	12521357	16616401	60
1	6020473	7984604	7540102	13262420	12524102	16609990	59
2	6022795	7982852	7544666	13254397	12526850	16603585	58
3	6025117	7981100	7549232	13246381	12529601	16597157	57
4	6027439	7979347	7553799	13238371	12532353	16590795	56
5	6029760	7977593	7558369	13230368	12535108	16584409	55
6	6032080	7975839	7562941	13222372	12537865	16578030	54
7	6034400	7974084	7567514	13214373	12540625	16571657	53
8	6036719	7972328	7572090	13206393	12543387	16565290	52
9	6039038	7970572	7576668	13198414	12546151	16558929	51
10	6941356	7968815	7581248	13190441	12548917	16552575	50
11	6043674	7967057	7585829	13182474	12551685	16546227	49
12	6045991	7965299	7590413	13174513	12554456	16539885	48
13	6048308	7963540	7594999	13166559	12557229	16533550	47
14	6050624	7961780	7599587	13158610	12560005	16527221	46
15	6052940	7960020	7604177	13150668	12562782	16520898	45
16	6055255	7958259	7608769	13142731	12565562	16514581	44
17	6057570	7956497	7613363	13134801	12568345	16508270	43
18	6059884	7954735	7617959	13126876	12571129	16501966	42
19	6062198	7952972	7622557	13118958	12573916	16495668	41
20	6064511	7951208	7627157	13111046	12576705	16489376	40
21	6065823	7949443	7631759	13103140	12579497	16483090	39
22	6069135	7947678	7636363	13095239	12582291	16476811	38
23	6071447	7945912	7640969	13087345	12585087	16470537	37
24	6073758	7944146	7645577	13079457	12587885	16464270	36
25	6076069	7942379	7650188	13071575	12590686	16458009	35
26	6078379	7940611	7654800	13063699	12593489	16451754	34
27	6080689	7938843	7659414	13055828	12596294	16445506	33
28	6082998	7937074	7664031	13047964	12599102	16439263	32
29	6085306	7935304	7668649	13040106	12601912	16433027	31
30	6087614	7933533	7673270	13032254	12604724	16426796	30
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co-Secant.	N. Secant.	M

52 DEGREES.

A Table of the Latitude and Longitude

The Places Names.	North Latitud. D.	North Latitud. M.	Eaſt Longit. D.	Eaſt Longit. M.
Cape Sille	37	15	31	52
Cape Matapan	36	28	30	53
Caſteltornis	37	45	30	32
Drugromaſtra	38	38	30	40
Cape Linga	40	18	29	38
Hiraſſa	40	57	30	38
Antavara	41	49	30	54
Cattaro	42	21	29	47
Raguſſa	42	29	28	57
Stanio	42	57	28	11

The Places Names.	North Latitud. D.	North Latitud. M.	Eaſt Longit. D.	Eaſt Longit. M.
Trovor	43	30	27	37
Cape Caſta	43	27	26	48
Salonico	44	01	27	24
Zaro	44	05	26	39
Sagua	44	47	25	49

Iſlands in the Straits, *called the* Archipelago.

Sarfanto	36	57	33	39
Sarfo	37	17	33	22

37 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.7794630	9.9023486	9.8771144	10.1228856	10.0976514	10.2205370	60
1	9.7796306	9.9022534	9.8773772	10.1226228	10.0977466	10.2203694	59
2	9.7797981	9.9021581	9.8776400	10.1223600	10.0978419	10.2202019	58
3	9.7799655	9.9020628	9.8779027	10.1220973	10.0979372	10.2200345	57
4	9.7801328	9.9019674	9.8781654	10.1218346	10.0980326	10.2198672	56
5	9.7803000	9.9018719	9.8784281	10.1215719	10.0981281	10.2197000	55
6	9.7804671	9.9017764	9.8786907	10.1213093	10.0982236	10.2195329	54
7	9.7806341	9.9016808	9.8789533	10.1210467	10.0983192	10.2193659	53
8	9.7808010	9.9015852	9.8792155	10.1207845	10.0984148	10.2191990	52
9	9.7809677	9.9014895	9.8794782	10.1205218	10.0985105	10.2190323	51
10	9.7811344	9.9013938	9.8797407	10.1202593	10.0986062	10.2188656	50
11	9.7813010	9.9012980	9.8800031	10.1199969	10.0987020	10.2186990	49
12	9.7814675	9.9012021	9.8802654	10.1197346	10.0987979	10.2185325	48
13	9.7816339	9.9011062	9.8805277	10.1194723	10.0988938	10.2183661	47
14	9.7818002	9.9010102	9.8807900	10.1192100	10.0989898	10.2181998	45
15	9.7819664	9.9009142	9.8810522	10.1189478	10.0990858	10.2180336	45
16	9.7821324	9.9008181	9.8813144	10.1186856	10.0991819	10.2178676	44
17	9.7822984	9.9007219	9.8815765	10.1184235	10.0992781	10.2177016	43
18	9.7824643	9.9006257	9.8818386	10.1181614	10.0993743	10.2175357	42
19	9.7826301	9.9005294	9.8821007	10.1178993	10.0994708	10.2173699	41
20	9.7827958	9.9004331	9.8823627	10.1176373	10.0995669	10.2172042	40
21	9.7829614	9.9003367	9.8826246	10.1173754	10.0996633	10.2170386	39
22	9.7831268	9.9002403	9.8828866	10.1171134	10.0997597	10.2168732	38
23	9.7832922	9.9001438	9.8831484	10.1168516	10.0998562	10.2167078	37
24	9.7834575	9.9000472	9.8834103	10.1165897	10.0999528	10.2165425	36
25	9.7836227	9.8999506	9.8836721	10.1163279	10.1000494	10.2163773	35
26	9.7837878	9.8998539	9.8839338	10.1160662	10.1901461	10.2162122	34
27	9.7839528	9.8997572	9.8841956	10.1158044	10.1002428	10.2160472	33
28	9.7841177	9.8996604	9.8844572	10.1155428	10.1003396	10.2158823	32
29	9.7842824	9.8995636	9.8847189	10.1152811	10.1004364	10.2157176	31
30	9.7844471	9.8994667	9.8849805	10.1150195	10.1005333	10.2155529	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

52 DEGREES.

of the Chiefeſt Places of the World.

The Places Names.	North Latitud. D.	North Latitud. M.	Eaſt Longit. D.	Eaſt Longit. M.
Famania	37	28	33	18
Trava	37	49	34	41
Pipor	39	32	33	51
Laſſor	39	58	33	51
Lamo	39	44	33	38
Stripo	39	16	33	51
St. Penaga	38	52	33	03
Andrea	38	12	34	46
Ipſava	38	28	35	11
Mortalin	39	54	35	52

The Places Names.	North Latitud. D.	North Latitud. M.	Eaſt Longit. D.	Eaſt Longit. M
Staviſratta	39	28	35	14
Lamnoſs	39	41	35	49
Embroſs	40	09	36	09
Palamos	40	14	36	04
Toſſa	40	00	35	19

Iſlands *in the* Straits.

Sapientia	36	47	30	16
Stouty	37	10	29	43

37 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N.Co-Secant.	
30	6087614	7933533	7673270	13032254	12604724	16426796	30
31	6089922	7931762	7677893	13024407	12607539	16420572	29
32	6092229	7929990	7682517	13016567	12610356	16414354	28
33	6094535	7928218	7687144	13008732	12613175	16408142	27
34	6096841	7926445	7691773	13000904	12615997	16401936	26
35	6099147	7924671	7696404	12993081	12618820	16395736	25
36	6101452	7922896	7701037	12985265	12621646	16389542	24
37	6103756	7921121	7705672	12977454	12624475	16383355	23
38	6106060	7919345	7710309	12969649	12627306	16377173	22
39	6108363	7917569	7714948	12961850	12630140	16370997	21
40	6110666	7915792	7719589	12954057	12632975	16364828	20
41	6112968	7914014	7724233	12946269	12635813	16358664	19
42	6115270	7912235	7728879	12938488	12638653	16352507	18
43	6117572	7910456	7733526	12930712	12641496	16346355	17
44	6119873	7908676	7738175	12922943	12644341	16340210	16
45	6122173	7906896	7742827	12915179	12647188	16334070	15
46	6124473	7905115	7747481	12907421	12650038	16327937	14
47	6126772	7903333	7752137	12899669	12652890	16321809	13
48	6129071	7901550	7756795	12891922	12655745	16315688	12
49	6131369	7899767	7761455	12884182	12658601	16309572	11
50	6133666	7897983	7766117	12876447	12661460	16303462	10
51	6135963	7896198	7770782	12868718	12664322	16297359	9
52	6138260	7894413	7775448	12860995	12667186	16291261	8
53	6140556	7892627	7780117	12853277	12670052	16285169	7
54	6142852	7890841	7784788	12845566	12672021	16279083	6
55	6145147	7889054	7789460	12837860	12675792	16273003	5
56	6147442	7887266	7794135	12830160	12678665	16266929	4
57	6149736	7885477	7798812	12822466	12681541	16260861	3
58	6152029	7883688	7803492	12814776	12684419	16254799	2
59	6154322	7881898	7808173	12807093	12687299	16248743	1
60	6156615	7880107	7812856	12799416	12690182	16242692	0
	N. Co-Sine	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co-Secant.	N. Secant.	M

52 DEGREES.

37 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.7844471	9.8994667	9.8849805	10.1150195	10.1005333	10.2155529	30
31	9.7846117	9.8993697	9.8852420	10.1147580	10.1006303	10.2153883	29
32	9.7847762	9.8992727	9 8855035	10.1144965	10.1007273	10.2152238	28
33	9.7849406	9.8991756	9.8857650	10.1142350	10.1008244	10.2150594	27
34	9.7851049	9.8990784	9.8860264	10.1139736	10.1009216	10.2148951	26
35	9.7852691	9.8989812	9.8862878	10.1137122	10.1010188	10.2147309	25
36	9.7854332	9.8988840	9.8865492	10.1134508	10.1011160	10.2145668	24
37	9.7855972	9.8987867	9.8868105	10.1131895	10.1012133	10.2144028	23
38	9.7857611	9.8986893	9.8870718	10.1129282	10.1013107	10.2142389	22
39	9.7859249	9.8985919	9.8873330	10.1126670	10.1014081	10.2140751	21
40	9.7860886	9.8984944	9.8875942	10.1124058	10.1015056	10.2139114	20
41	9.7862522	9.8983968	9.8878554	10.1121446	10.1016032	10.2137478	19
42	9.7864157	9.8982992	9.8881165	10.1118835	10.1017008	10.2135843	18
43	9.7865791	9.8982015	9.8883775	10.1116225	10.1017985	10.2134209	17
44	9.7867424	9.8981038	9.8886386	10.1113614	10.1018962	10.2132576	16
45	9.7869056	9.8980060	9.8888996	10.1111004	10.1019940	10.2130944	15
46	9.7870687	9.8979082	9.8891605	10.1108395	10.1020918	10.2129313	14
47	9.7872317	9.8978103	9.8894214	10.1105786	10.1021897	10.2127683	13
48	9.7873946	9.8977123	9.8896823	10.1103177	10.1022877	10.2126054	12
49	9.7875574	9.8976143	9.8899432	10.1100565	10.1023857	10.2124426	11
50	9.7877202	9.8975162	9.8902040	10.1097960	10.1024838	10.2122798	10
51	9.7878828	9.8974181	9.8904647	10.1095353	10.1025819	10.2121172	9
52	9.7880453	9.8973199	9.8907254	10.1092746	10.1026801	10.2119547	8
53	9.7882077	9.8972216	9.8909861	10.1090139	10.1027784	10.2117923	7
54	9.7883701	9.8971233	9.8912468	10.1087532	10.1028767	10.2116299	6
55	9.7885323	9.8970249	9.8915074	10.1084926	10.1029751	10.2114677	5
56	9.7886944	9.8969265	9.8917679	10.1082321	10.1030735	10.2113056	4
57	9.7888565	9.8968280	9.8920285	10.1079715	10.1031720	10.2111435	3
58	9.7890184	9.8967294	9.8922890	10.1077110	10.1032706	10.2109816	2
59	9.7891802	9.8966308	9.8925494	10.1074506	10.1033692	10.2108198	1
60	9.7893420	9.8965321	9.8928098	10.1071902	10.1034679	10.2106580	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

52 DEGREES.

A Table of the Latitude and Longitude of the Chiefeſt Places of the World.

The Places Names.	North Latitud. D.	North Latitud. M.	Eaſt Longit. D.	Eaſt Longit. M.
Zant	37	37	29	38
Cape Sidro	38	15	29	33
Paxa	38	49	29	30
Corfu	39	26	29	26
Faimo	39	44	29	19
Seſſino	40	22	29	14
Pianaſſa	41	52	26	08
Trinite	41	50	25	53
Pollagaſſa	42	17	26	37
Mallida	42	37	28	03
Corſella	42	35	27	38
Auguſta	42	36	27	13
Catſſalla	42	40	27	03
Catſſo	42	44	26	58
Liſſa	43	00	26	33
Buzo	43	02	26	18
St. Andrea	43	07	25	58
Poma	43	14	25	48
Iſland Groſſo	44	00	25	36
Sauſſaga	44	20	25	02
Piper	35	52	22	15
Malta	36	00	21	54
Comino	36	15	21	24
Eaſt end of Cyprus	34	48	44	18
Middle of Cyprus	34	18	43	09
Weſt end of Cyprus	34	22	41	47
Rhodes	35	40	37	22
Sivia	36	05	37	17
Gozo	34	37	32	39
Eaſt end of Candia	35	04	35	32
Middle of Candia	35	08	33	56
Weſt end of Candia	35	15	32	25
Scarpanta	45	10	36	04
Caros	35	35	35	39
Langa	36	33	36	02
Stampalia	36	11	34	59
Levatta	36	38	34	54
Niza	37	02	34	31
Cavari	36	40	32	16
Palla	36	52	32	09

38 DEGREES.

M	N. Sine.	N. Co-sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	6156615	7880107	7812856	12799416	12690182	16242692	60
1	6158907	7878316	7817542	12791745	12693067	16236648	59
2	6161198	7876524	7822229	12784076	12695955	16230609	58
3	6163489	7874732	7826919	12776419	12698845	16224576	57
4	6165779	7872939	7831611	12768764	12701737	16218549	56
5	6168069	7871145	7836305	12761116	12704632	16212528	55
6	6170359	7869350	7841002	12753473	12707529	16206513	54
7	6172648	7867555	7845700	12745836	12710429	16200504	53
8	6174936	7865759	7850400	12738204	12713331	16194500	52
9	6177224	7863962	7855103	12730578	12716235	16188502	51
10	6179511	7862165	7859808	12722957	12719142	16182510	50
11	6181798	7860367	7864515	12715342	12722051	16176524	49
12	6184084	7858569	7869224	12707733	12724963	16170544	48
13	6186370	7856770	7873935	12700130	12727877	16164569	47
14	6188655	7854970	7878649	12692532	12730794	16158600	46
15	6190940	7853169	7883364	12684939	12733712	16152637	45
16	6193224	7851368	7888082	12677353	12736634	16146680	44
17	6195507	7849566	7892802	12669772	12739557	16140728	43
18	6197790	7847764	7897524	12662196	12742484	16134783	42
19	6200073	7845961	7902248	12654626	12745412	16128843	41
20	6202355	7844157	7906975	12647062	12748343	16122908	40
21	6204636	7842352	7911703	12639503	12751276	16116980	39
22	6206917	7840547	7916434	12631950	12754212	16111057	38
23	6209198	7838741	7921167	12624402	12757150	16105140	37
24	6211478	7836935	7925902	12616860	12760091	16099228	36
25	6213757	7835128	7930640	12609323	12763034	16093323	35
26	6216036	7833320	7935379	12601792	12765980	16087423	34
27	6218314	7831511	7940121	12594267	12768928	16081528	33
28	6220592	7829702	7944865	12586747	12771878	16075640	32
29	6222869	7827892	7949611	12579232	12774831	16069757	31
30	6225146	7826082	7954359	12571723	12777787	16063879	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

51 DEGREES.

A Table of the Latitude and Longitude

The Places Names.	North Latitud D.	North Latitud M	East Longit. D.	East Longit. M.	The Places Names.	North Latitud D.	North Latitud M.	East Longit. D.	East Longit. M.
Cardinals Hats	37	25	32	31	Meſſina	38	07	23	21
Forleonari	36	59	32	37	*East end of* Sicilia	37	07	23	24
Millo	36	40	33	19	*Middle of* Sicilia	37	42	22	09
Goza	35	41	20	51	*West end of* Sicilia	37	52	20	07
Samatto	35	46	19	39	Uſtica	38	50	20	58
Lampadoſſa	35	58	19	59	Allicur	38	45	21	47
Linoſſa	36	20	20	05	Fallieur	38	43	22	01
Pantalaria	36	53	19	35	Liſtallin	38	34	22	32
Kambro	37	10	18	34	Lipari	38	40	22	27
Maritimo	37	52	20	02	Volcana	38	48	22	30

38 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.7893420	9.8965321	9.8928098	10.1071902	10.1034679	10.2106580	60
1	9.7895036	9.8964334	9.8930702	10.1069298	10.1035666	10.2104964	59
2	9.7896652	9.8963346	9.8933306	10.1066694	10.1036654	10.2103348	58
3	9.7898265	9.8962358	9.8935909	10.1064091	10.1037642	10.2101734	57
4	9.7899880	9.8961369	9.8938511	10.1061489	10.1038631	10.2100120	56
5	9.7901493	9.8960379	9.8941114	10.1058886	10.1039621	10.2098507	55
6	9.7903104	9.8959389	9.8943715	10.1056285	10.1040611	10.2096896	54
7	9.7904715	9.8958398	9.8946317	10.1053683	10.1041602	10.2095285	53
8	9.7906325	9.8957406	9.8948918	10.1051082	10.1042594	10.2093675	52
9	9.7907933	9.8956414	9.8951519	10.1048481	10.1043586	10.2092067	51
10	9.7909541	9.8955422	9.8954119	10.1045881	10.1044578	10.2090459	50
11	9.7911148	9.8954429	9.8956719	10.1043281	10.1045572	10.2088852	49
12	9.7912754	9.8953435	9.8959319	10.1040681	10.1046565	10.2087246	48
13	9.7914359	9.8952440	9.8961918	10.1038082	10.1047560	10.2085641	47
14	9.7915963	9.8951445	9.8964517	10.1035483	10.1048555	10.2084037	46
15	9.7917566	9.8950450	9.8967116	10.1032884	10.1049550	10.2082434	45
16	9.7919168	9.8949453	9.8969714	10.1030286	10.1050547	10.2080832	44
17	9.7920769	9.8948457	9.8972312	10.1027688	10.1051543	10.2079231	43
18	9.7922369	9.8947459	9.8974910	10.1025090	10.1052541	10.2077631	42
19	9.7923968	9.8946461	9.8977507	10.1022493	10.1053539	10.2076032	41
20	9.7925566	9.8945463	9.8980104	10.1019896	10.1054537	10.2074434	40
21	9.7927163	9.8944463	9.8982700	10.1017300	10.1055537	10.2072837	39
22	9.7928760	9.8943464	9.8985296	10.1014704	10.1056536	10.2071240	38
23	9.7930355	9.8942463	9.8987892	10.1012108	10.1057537	10.2069645	37
24	9.7931949	9.8941462	9.8990487	10.1009513	10.1058538	10.2068051	36
25	9.7933543	9.8940461	9.8993082	10.1006918	10.1059539	10.2066457	35
26	9.7935135	9.8939458	9.8995677	10.1004323	10.1060542	10.2064865	34
27	9.7936727	9.8938456	9.8998271	10.1001729	10.1061544	10.2063273	33
28	9.7938317	9.8937452	9.9000865	10.0999135	10.1062548	10.2061683	32
29	9.7939907	9.8936448	9.9003459	10.0996541	10.1063552	10.2060093	31
30	9.7941496	9.8935444	9.9006052	10.0993948	10.1064556	10.2058504	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

51 DEGREES.

of the Chiefest Places of the World.

The Places Names.	North Latitud D.	North Latitud M	East Longit. D.	East Longit. M.	The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Stromballa	39	03	23	02	Caprera	42	49	18	21
Foldemaſſina	38	20	23	29	Gargona	43	20	18	28
Iſcia	40	46	21	36	*North end of* Corſica	42	55	17	26
Ponuſſa	40	40	20	32	*Middle of* Corſica	42	05	17	07
Palmarolla	40	50	19	59	*South end of* Corſica	41	20	17	01
Ginnute	41	59	19	48	Taloro	40	56	17	19
Gigio	41	58	19	39	Azanera	41	08	16	22
Criſta	41	55	18	51	*North end of* Sardinia	41	10	17	25
Planoſſa	42	07	18	33	*Middle of* Sardinia	40	06	16	54
Lilbo	42	31	18	36	*South end of* Sardinia	38	56	16	37

38 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	6225146	7826082	7954359	12571723	12777787	16063879	30
31	6227422	7824271	7959110	12564219	12780745	16058008	29
32	6229698	7822459	7963862	12556721	12783705	16052142	28
33	6231973	7820646	7968617	12549229	12786667	16046281	27
34	6234248	7818833	7973374	12541742	12789632	16040426	26
35	6236522	7817019	7978134	12534260	12792600	16034577	25
36	6238796	7815205	7982895	12526784	12795570	16028734	24
37	6241069	7813390	7987659	12519313	12798543	16022896	23
38	6243342	7811574	7992425	12511848	12801518	16017064	22
39	6245614	7809757	7997193	12504388	12804495	16011237	21
40	6247885	7807940	8001963	12496933	12807475	16005416	20
41	6250156	7806122	8006736	12489484	12810457	15999600	19
42	6252426	7804304	8011511	12482040	12813442	15993790	18
43	6254696	7802485	8016288	12474602	12816430	15987986	17
44	6256966	7800665	8021067	12467169	12819420	15982187	16
45	6259235	7798845	8025848	12459742	12822412	15976394	15
46	6261503	7797024	8030632	12452320	12825407	15970606	14
47	6263771	7795202	8035418	12444903	12828404	15964824	13
48	6266038	7793380	8040206	12437492	12831404	15959047	12
49	6268305	7791557	8044997	12430086	12834406	15953276	11
50	6270571	7789733	8049790	12422685	12837411	15947511	10
51	6272837	7787908	8054585	12415290	12840418	15941751	9
52	6275102	7786083	8059382	12407900	12843428	15935996	8
53	6277366	7784257	8064181	12400515	12846440	15930247	7
54	6279630	7782431	8068983	12393136	12849455	15924504	6
55	6281894	7780604	8073787	12385762	12852472	15918766	5
56	6284157	7778777	8078593	12378393	12855492	15913033	4
57	6286420	7776949	8083401	12371030	12858514	15907306	3
58	6288682	7775120	8088212	12363672	12861539	15901584	2
59	6290943	7773290	8093025	12356319	12864566	15895868	1
60	6293204	7771460	8097840	12348972	12867596	15890157	0
	N. Co-Sine	N. Sine.	N.Co-Tang	N. Tangent.	N.Co Secant.	N. Secant.	M

51 DEGREES.

38 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.7941496	9.8935444	9.9006052	10.0993948	10.1064556	10.2058504	30
31	9.7943083	9.8934439	9.9008645	10.0991355	10.1065561	10.2056917	29
32	9.7944670	9.8933433	9.9011237	10.0988763	10.1066567	10.2055330	28
33	9.7946256	9.8932426	9.9013830	10.0986170	10.1067574	10.2053744	27
34	9.7947841	9.8931419	9.9016422	10.0983578	10.1068581	10.2052159	26
35	9.7949425	9.8930412	9.9019013	10.0980987	10.1069588	10.2050575	25
36	9.7951008	9.8929404	9.9021604	10.0978396	10.1070596	10.2048992	24
37	9.7952590	9.8928395	9.9024195	10.0975805	10.1071605	10.2047410	23
38	9.7954171	9.8927385	9.9026786	10.0973214	10.1072615	10.2045829	22
39	9.7955751	9.8926375	9.9029376	10.0970624	10.1073625	10.2044249	21
40	9.7957330	9.8925365	9.9031965	10.0968034	10.1074635	10.2042670	20
41	9.7958909	9.8924354	9.9034555	10.0965445	10.1075646	10.2041091	19
42	9.7960486	9.8923342	9.9037144	10.0962856	10.1076658	10.2039514	18
43	9.7962062	9.8922329	9.9039733	10.0960267	10.1077671	10.2037638	17
44	9.7963638	9.8921316	9.9042321	10.0957679	10.1078684	10.2036362	16
45	9.7965212	9.8920303	9.9044910	10.0955090	10.1079697	10.2034788	15
46	9.7966786	9.8919289	9.9047497	10.0952503	10.1080711	10.2033214	14
47	9.7968359	9.8918274	9.9050085	10.0949915	10.1081726	10.2031641	13
48	9.7969930	9.8917258	9.9052672	10.0947328	10.1082742	10.2030070	12
49	9.7971501	9.8916242	9.9055259	10.0944741	10.1083758	10.2028499	11
50	9.7973071	9.8915226	9.9057845	10.0942155	10.1084774	10.2026929	10
51	9.7974640	9.8914208	9.9060431	10.0939569	10.1085792	10.2025360	9
52	9.7976208	9.8913191	9.9063017	10.0936983	10.1086809	10.2023792	8
53	9.7977775	9.8912172	9.9065603	10.0934397	10.1087828	10.2022225	7
54	9.7979341	9.8911153	9.9068188	10.0931812	10.1088847	10.2020659	6
55	9.7980906	9.8910133	9.9070773	10.0929227	10.1089867	10.2019094	5
56	9.7982470	9.8909113	9.9073357	10.0926643	10.1090887	10.2017530	4
57	9.7984034	9.8908092	9.9075941	10.0924059	10.1091908	10.2015966	3
58	9.7985596	9.8907071	9.9078525	10.0921475	10.1092929	10.2014404	2
59	9.7987158	9.8906049	9.9081109	10.0918891	10.1093951	10.2012842	1
60	9.7988718	9.8905026	9.9083692	10.0916308	10.1094974	10.2011282	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

51 DEGREES.

A Table of the Latitude and Longitude *of the Chiefest Places of the World.*

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
The Island of St. Pedra	39	20	16	03
Pallmade follo	39	11	16	05
Sarpentara	39	00	17	18
Callatta	37	57	16	28
Minorca	39	55	12	16
Majorca	39	38	11	12
Cabrea	39	07	11	05
Collombratta	39	50	08	44
Eviffa	39	05	09	57
Formentara	38	44	09	54

The Canary Iflands.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Forta Ventura	28	12	06	28
Lancelotte	28	51	06	08
Allegranffa	29	11	06	13
Grand Canary	27	43	08	31
Teneriff	28	20	09	28
Gomero	28	09	10	15
Ferro	28	05	10	43

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Palma	28	58	10	42
Salvagas	30	05	08	57
Dazarts	32	08	09	46
Madera	32	27	11	19
Port-Santo	33	14	10	09

The Weftern Iftands.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Abraofo	37	55	29	46
Vafo	40	30	27	28
Corvo	40	09	24	59
Flauris	39	30	24	55
Fiall	38	49	22	13
Pico	38	30	21	37
St. George	39	00	21	20
Tercera	39	31	20	22
Gratioffa	39	30	21	11
Abrajo	39	52	18	53
Vajo	38	43	18	23
St. Michael	38	00	18	16

39 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N. Co-Secant.	
0	6293204	7771460	8097840	12348972	12867596	15890157	60
1	6295464	7769629	8102658	12341629	12870628	15884452	59
2	6297724	7767797	8107478	12334292	12873663	15878752	58
3	6299983	7765965	8112300	12326961	12876700	15873058	57
4	6302242	7764132	8117124	12319634	12879740	15867369	56
5	6304500	7762298	8121951	12312313	12882782	15861685	55
6	6306758	7760464	8126780	12304997	12885827	15856007	54
7	6309015	7758629	8131611	12297687	12888875	15850334	53
8	6311272	7756794	8136444	12290381	12891925	15844667	52
9	6313528	7754958	8141280	12283081	12894977	15839005	51
10	6315784	7753121	8146118	12275786	12898032	15833348	50
11	6318039	7751283	8150958	12268496	12901090	15827697	49
12	6320293	7749445	8155801	12261211	12904150	15822051	48
13	6322547	7747606	8160646	12253932	12907213	15816411	47
14	6324800	7745767	8165493	12246658	12910278	15810776	46
15	6327053	7743927	8170343	12239389	12913346	15805146	45
16	6329305	7742086	8175195	12232125	12916416	15799521	44
17	6331557	7740244	8180049	12224866	12919489	15793902	43
18	6333808	7738402	8184905	12217613	12922564	15788289	42
19	6336059	7736559	8189764	12210364	12925642	15782680	41
20	6338309	7734716	8194625	12203121	12928723	15777077	40
21	6340559	7732872	8199488	12195883	12931806	15771479	39
22	6342808	7731027	8204354	12188650	12934892	15765887	38
23	6345057	7729182	8209222	12181422	12937980	15760300	37
24	6347305	7727336	8214093	12174199	12941071	15754718	36
25	6349553	7725489	8218965	12166982	12944164	15749141	35
26	6351800	7723642	8223840	12159769	12947260	15743570	34
27	6354046	7721794	8228718	12152562	12950359	15738004	33
28	6356292	7719945	8233597	12145359	12953460	15732443	32
29	6358537	7718096	8238479	12138162	12956564	15726887	31
30	6360782	7716246	8243364	12130970	12959670	15721337	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

50 DEGREES.

A Table of the Latitude and Longitude

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
Horningo	37	25	17	36
St. Maria	37	00	17	56
Vejo	42	22	18	56
Iſland Varda	44	48	22	46
Maiden Iſland	46	30	23	36
Old Brazeel	51	03	09	56

The Cape de Verd Iſlands.

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
Brava	14	49	15	14
Fogo	14	42	14	56
St. Jago	14	52	14	22
Maya	15	00	14	02
Bonaviſta	15	58	13	49
Sal	17	00	13	26
St. Nicholas	16	30	15	44
St. Lucia	16	50	16	08

39 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.7988718	9.8905026	9.9083629	10.0916308	10.1094974	10.2011282	60
1	9.7990278	9.8904003	9.9086275	10.0913725	10.1095997	10.2009722	59
2	9.7991836	9.8902979	9.9088858	10.0911142	10.1097021	10.2008164	58
3	9.7993394	9.8901954	9.9091440	10.0908560	10.1098046	10.2006606	57
4	9.7994951	9.8900929	9.9094022	10.0905978	10.1099071	10.2005049	56
5	9.7996507	9.8899903	9.9096603	10.0903397	10.1100097	10.2003493	55
6	9.7998062	9.8898877	9.9099185	10.0900815	10.1101123	10.2001938	54
7	9.7999616	9.8897850	9.9101766	10.0898234	10.1102150	10.2000384	53
8	9.8001169	9.8896822	9.9104347	10.0895653	10.1103178	10.1998831	52
9	9.8002721	9.8895794	9.9106927	10.0893073	10.1104206	10.1997279	51
10	9.8004272	9.8894765	9.9109507	10.0890493	10.1105235	10.1995728	50
11	9.8005823	9.8893736	9.9112087	10.0887913	10.1106264	10.1994177	49
12	9.8007372	9.8892706	9.9114666	10.0885334	10.1107294	10.1992628	48
13	9.8008921	9.8891675	9.9117245	10.0882755	10.1108325	10.1991079	47
14	9.8010468	9.8890644	9.9119824	10.0880176	10.1109356	10.1989532	46
15	9.8012015	9.8889612	9.9122403	10.0877597	10.1110388	10.1987985	45
16	9.8013561	9.8888580	9.9124981	10.0875019	10.1111420	10.1986439	44
17	9.8015106	9.8887547	9.9127559	10.0872441	10.1112453	10.1984894	43
18	9.8016649	9.8886513	9.9130137	10.0869863	10.1113487	10.1983351	42
19	9.8018192	9.8885479	9.9132714	10.0867286	10.1114521	10.1981808	41
20	9.8019735	9.8884444	9.9135291	10.0864709	10.1115556	10.1980265	40
21	9.8021276	9.8883408	9.9137868	10.0862132	10.1116592	10.1978724	39
22	9.8022816	9.8882372	9.9140444	10.0859556	10.1117627	10.1977184	38
23	9.8024355	9.8881335	9.9143020	10.0856980	10.1118665	10.1975645	37
24	9.8025894	9.8880298	9.9145596	10.0854404	10.1119702	10.1974106	36
25	9.8027431	9.8879260	9.9148171	10.0851829	10.1120740	10.1972569	35
26	9.8028968	9.8878221	9.9150747	10.0849253	10.1121779	10.1971032	34
27	9.8030504	9.8877182	9.9153322	10.0846678	10.1122818	10.1969495	33
28	9.8032038	9.8876142	9.9155896	10.0844104	10.1123858	10.1967962	32
29	9.8033572	9.8875102	9.9158471	10.0841529	10.1124898	10.1966428	31
30	9.8035105	9.8874061	9.9161045	10.0838955	10.1125939	10.1964895	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

50 DEGREES.

of the Chiefeſt Places of the World.

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
St. Vincent	16	55	16	32
St. Antonio	17	07	16	56
Cape Blanco	20	30	00	26
Cape Boyador	26	55	02	52
Marquepana	27	22	02	11
Cape Denao	28	52	01	46
Cape Gillam	29	50	01	29
Cape de Ger	30	30	01	25
Cape Cantin	32	27	01	06
Tangeir, *Eaſt Longitude.*	35	36	01	49

The Sea-Coaſt of Iſeland Iſland.

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
Mage Naſs	61	32	02	5[illegible]
Merchant Foreland	63	52	11	42
Horn	63	42	10	16
Silly	64	5[illegible]	09	5[illegible]
Bargaſar Point	65	27	07	01
Long Naſs	66	26	07	36
Grimſa	66	42	09	20

39 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	6360782	7716246	8243364	12130970	12959670	15721337	30
31	6363026	7714395	8248251	12123783	12962779	15715792	29
32	6365270	7712544	8253140	12116601	12965890	15710252	28
33	6367513	7710692	8258030	12109424	12969004	15704717	27
34	6369756	7708839	8262925	12102252	12972121	15699188	26
35	6371998	7706986	8267821	12095085	12975240	15693664	25
36	6374240	7705132	8272719	12087923	12978362	15688145	24
37	6376481	7703278	8277620	12080767	12981487	15682631	23
38	6378721	7701423	8282523	12073615	12984614	15677123	22
39	6380961	7699567	8287429	12066468	12987744	15671619	21
40	6383201	7697710	8292337	12059327	12990876	15666121	20
41	6385440	7695853	8297247	12052190	12994011	15660628	19
42	6387678	7693995	8302160	12045058	12997148	15655141	18
43	6389916	7692137	8307075	12037931	13000288	15649658	17
44	6392153	7690278	8311992	12030810	13003431	15644181	16
45	6394390	7688418	8316912	12023693	13006576	15638708	15
46	6396626	7686558	8321834	12016581	13009724	15633241	14
47	6398862	7684697	8326759	12009475	13012875	15627779	13
48	6401097	7682835	8331686	12002373	13016028	15622322	12
49	6403332	7680973	8336615	11995276	13019184	15616870	11
50	6405566	7679110	8341547	11988184	13022343	15611424	10
51	6407799	7677246	8346481	11981097	13025504	15605982	9
52	6410032	7675382	8351418	11974015	13028668	15600546	8
53	6412264	7673517	8356357	11966938	13031834	15595115	7
54	6414496	7671651	8361298	11959866	13035003	15589689	6
55	6416727	7669785	8366242	11952799	13038175	15584267	5
56	6418958	7667918	8371188	11945736	13041349	15578851	4
57	6421188	7666051	8376136	11938679	13044526	15573441	3
58	6423418	7664183	8381087	11931626	13047706	15568035	2
59	6425647	7662314	8386040	11924579	13050888	15562634	1
60	6427876	7660444	8390996	11917536	13054073	15557238	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

50 DEGREES.

39 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.8035105	9.8874061	9.9161045	10.0838955	10.1125939	10.1964895	30
31	9.8036637	9.8873019	9.9193618	10.0836382	10.1126981	10.1963363	29
32	9.8038168	9.8871977	9 9166192	10.0833808	10.1128023	10.1961832	28
33	9.8039699	9.8870934	9.9168765	10.0831235	10.1129066	10.1960301	27
34	9.8041228	9.8869890	9.9171338	10.0828662	10.1130110	10.1958772	26
35	9.8042757	9.8868846	9.9173911	10.0826089	10.1131154	10.1957243	25
36	9.8044284	9.8867801	9.9176483	10.0823517	10.1132199	10.1955716	24
37	9.8045811	9.8866756	9.9179055	10.0820945	10.1133244	10.1954189	23
38	9.8047336	9.8865710	9.9181627	10.0818373	10.1134290	10.1952664	22
39	9.8048861	9.8864663	9.9184198	10.0815802	10.1135337	10.1951139	21
40	9.8050385	9.8863616	9.9186769	10.0813231	10.1136384	10.1949615	20
41	9.8051908	9.8862568	9.9189340	10.0810660	10.1137432	10.1948092	19
42	9.8053430	9.8861519	9.9191911	10.0808089	10.1138481	10.1946570	18
43	9.8054951	9.8860470	9.9194481	10.0805519	10.1139530	10.1945049	17
44	9.8056472	9.8859420	9.9197051	10.0802949	10.1140580	10.1943528	16
45	9.8057991	9.8858370	9.9199621	10.0800379	10.1141630	10.1942008	15
45	9.8059510	9.8857319	9.9202191	10.0797809	10.1142681	10.1940490	14
47	9.8061027	9.8856267	9.9204760	10.0795240	10.1143733	10.1938973	13
48	9.8062544	9.885[illegible]215	9.9207329	10.0792671	10.1144785	10.1937456	12
49	9.8064060	9.8854162	9.9209898	10.0790102	10.1145838	10.1935940	11
50	9.8065575	9.8853109	9.9212466	10.0787534	10.1146891	10.1934425	10
51	9.8067089	9.8852055	9.9215034	10.0784966	10.1147945	10.1932911	9
52	9.8068602	9.8851000	9.9217602	10.0782398	10.1149000	10.1931398	8
53	9.8070114	9.8849945	9.9220170	10.0779830	10.1150055	10.1529886	7
54	9.8071626	9.8848889	9.9222737	10.0777263	10.1151111	10.1928374	6
55	9.8073136	9.8847832	9.9225304	10.0774696	10.1152168	10.1926864	5
56	9.8074646	9.8846775	9.9227871	10.0772129	10.1153225	10.1925354	4
57	9.8076154	9.8845717	9.9230437	10.0769563	10.1154283	10.1923846	3
58	9.8077662	9.8844659	9.9233004	10.0766996	10.1155341	10.1922338	2
59	9.8079169	9.8843599	9.9235570	10.0764430	10.1156401	10.1920831	1
60	9.8080675	9.8842540	9.9238135	10.0761865	10.1157460	10.1919325	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

50 DEGREES.

A Table of the Latitude and Longitude of the Chiefest Places of the World.

The Places Names.	*North Latitud.* D.	M.	*East Longit.* D.	M.
Marza	67	08	09	42
Rage Point	66	40	12	00
Fair Foreland	65	40	14	53
Snow Hill	65	11	14	50
Rook Point	64	00	14	05
West main Isles	63	17	12	53
Gammat Isles	63	48	15	06
Grimes Hole	63	23	15	46

The Coast of the North-West Discovery.

The Places Names.	*North Latitud* D.	M.	*East Longit.* D.	M.
Cape Farewel	59	00	41	50
Sir Thomas Smith's Bay	79	10	79	50
Botton's Isles	60	20	62	50
Bell Isle	51	02	48	44

The Sea-Coast of New-found-Land, *and* New-England.

The Places Names.	*North Latitud.* D.	M.	*East Longit.* D.	M.
Cape Honblanto	52	11	50	14
Bell-Isle	51	02	48	44
Cape Bonavista	49	19	47	42
Trinity Bay	48	54	49	04
Bacalao	48	40	46	55
Consumption Bay	48	21	47	49

The Places Names.	*North Latitud.* D.	M.	*East Longit.* D.	M.
Cape *St.* Francis	48	01	47	27
Cape Despair	47	36	46	03
Cape de Raca	46	27	46	30
Bay Bulls	47	28	47	11
St John's *Harbour*	47	47	47	21
Plazentia Bay	47	32	47	41
Cape *St.* Larinso	47	10	48	59
Island *St.* Paly	47	36	50	18
Cape Raya	48	05	52	49
Cape Deganica	54	01	53	21

40 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	6427876	7660444	8390995	11917536	13054073	15557238	60
1	6430104	7658574	8395954	11910498	13057261	15551848	59
2	6432332	7656703	8400915	11903465	13060451	15546462	58
3	6434559	7654832	8405878	11896437	13063644	15541081	57
4	6436785	7652960	8410844	11889414	13066839	15535706	56
5	6439011	7651087	8415812	11882395	13070037	15530335	55
6	6441236	7649214	8420782	11875382	13073238	15524970	54
7	6443461	7647340	8425755	11868373	13076442	15519609	53
8	6445685	7645465	8430730	11861369	13079649	15514254	52
9	6447909	7643590	8435708	11854370	13082858	15508904	51
10	6450132	7641714	8440688	11847376	13086070	15503558	50
11	6452355	7639837	8445670	11840387	13089284	15498218	49
12	6454577	7637960	8450655	11833402	13092501	15492882	48
13	6456798	7636082	8455643	11826422	13095721	15487552	47
14	6459019	7634204	8460633	11819447	13098943	15482226	46
15	6461240	7632325	8465625	11812477	13102168	15476906	45
16	6463460	7630445	8470620	11805512	13105396	15471590	44
17	6465679	7628564	8475617	11798551	13108626	15466280	43
18	6467898	7626683	8480617	11791595	13111859	15460974	42
19	6470116	7624801	8485619	11784644	13115095	15455673	41
20	6472334	7622919	8490624	11777698	13118334	15450378	40
21	6474551	7621036	8495631	11770756	13121575	15445087	39
22	6476767	7619152	8500640	11763820	13124819	15439801	38
23	6478983	7617268	8505652	11756888	13128066	15434520	37
24	6481199	7615383	8510667	11749960	13131316	15429244	36
25	6483414	7613497	8515684	11743038	13134568	15423973	35
26	6485628	7611611	8520704	11736120	13137823	15418706	34
27	6487842	7609724	8525726	11729207	13141081	15413445	33
28	6490055	7607837	8530750	11722298	13144341	15408189	32
29	6492268	7605949	8535777	11715395	13147604	15402937	31
30	6494480	7604060	8540807	11708496	13150870	15397690	30
	N. Co-Sine	N. Sine.	N.Co-Tang	N. Tangent.	N.Co Secant.	N. Secant.	M

49 DEGREES.

40 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.8080675	9.8842540	9.9238135	10.0761865	10.1157460	10.1919325	60
1	9.8082180	9.8841479	9.9240701	10.0759299	10.1158521	10.1917820	59
2	9.8083684	9.8840418	9.9243266	10.0756734	10.1159582	10.1916316	58
3	9.8085188	9.8839357	9.9245831	10.0754169	10.1160643	10.1914812	57
4	9.8086690	9.8838294	9.9248396	10.0751604	10.1161706	10.1913310	56
5	9.8088192	9.8837232	9.9250960	10.0749040	10.1162768	10.1911808	55
6	9.8089692	9.8836168	9.9253524	10.0746476	10.1163832	10.1910308	54
7	9.8091192	9.8835104	9.9256088	10.0743912	10.1164896	10.1908808	53
8	9.8092691	9.8834039	9.9258652	10.0741348	10.1165961	10.1907309	52
9	9.8094189	9.8832974	9.9261215	10.0738785	10.1167026	10.1905811	51
10	9.8095686	9.8831908	9.9263778	10.0736222	10.1168092	10.1904314	50
11	9.8097182	9.8830841	9.9266341	10.0733659	10.1169159	10.1902818	49
12	9.8098678	9.8829774	9.9268904	10.0731096	10.1170225	10.1901322	48
13	9.8100172	9.8828706	9.9271466	10.0728534	10.1171291	10.1899828	47
14	9.8101666	9.8827638	9.9274028	10.0725972	10.1172362	10.1898334	45
15	9.8103159	9.8826568	9.9276599	10.0723410	10.1173432	10.1896841	45
16	9.8104650	9.8825499	9.9279152	10.0720848	10.1174501	10.1895350	44
17	9.8106141	9.8824428	9.9281713	10.0718287	10.1175572	10.1893859	43
18	9.8107631	9.8823357	9.9284274	10.0715726	10.1176643	10.1892369	42
19	9.8109121	9.8822285	9.9286835	10.0713165	10.1177715	10.1890879	41
20	9.8110609	9.8821213	9.9289396	10.0710604	10.1178787	10.1889391	40
21	9.8112096	9.8820140	9.9291956	10.0708044	10.1179860	10.1887904	39
22	9.8113583	9.8819067	9.9294516	10.0705484	10.1180933	10.1886417	38
23	9.8115069	9.8817992	9.9297076	10.0702924	10.1182008	10.1884931	37
24	9.8116554	9.8816918	9.9299636	10.0700364	10.1183082	10.1883446	36
25	9.8118038	9.8815842	9.9302195	10.0697805	10.1184158	10.1881962	35
26	9.8119521	9.8814766	9.9304755	10.0695245	10.1185234	10.1880479	34
27	9.8121003	9.8813689	9.9307314	10.0692686	10.1186311	10.1878997	33
28	9.8122484	9.8812612	9.9309872	10.0690128	10.1187388	10.1877516	32
29	9.8123965	9.8811534	9.9312431	10.0687569	10.1188466	10.1876035	31
30	9.8125444	9.8810455	9.9314989	10.0685011	10.1189545	10.1874556	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

49 DEGREES.

A Table of the Latitude and Longitude of the Chiefest Places of the World.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
New-Eng. *Cape* S. Charles	52	48	52	23
Cape Britain	46	01	52	57
Cape Salila	43	46	55	22
Cape Cod	42	21	61	32
Boston	42	39	64	36
Plymouth	42	07	62	35
Nantucket	41	08	60	17
Mattins Tinyard	41	17	61	12

The Sea-Coasts on the main Continent in America, *or* West-India.

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Elizabeth *Island*	41	02	62	04
Bloik Island	40	5	62	36
Long Island	40	45	63	16
Cape May	39	55	64	45
Virginia. Cape Charles	37	47	65	26
Cape Henry	37	01	65	38
Cape Hatcrass	35	49	65	46
Cape Fara	34	06	69	56
Cape de Catocha	21	23	80	37
Cape de Camaron	16	05	76	19
Cape de Gratias	15	31	70	56
Cattergaine	10	24	65	06
Bay Tonto	12	10	62	36
Cape *St.* Roman	11	55	60	36
Cape Dacodara	11	08	56	38
Cape Trag, *or* 3 Points	11	17	55	41
Cape Brama	09	21	54	16
Cape Dasbassas	08	20	53	11
Suramo	06	09	50	56
Surinam	05	58	49	52

The West-India *Islands.*

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
Defonsseaca Island	12	23	48	30
La Burmuda	32	25	56	00
Behama	27	57	73	06

A TABLE of Natural and Artificial Sines, Tangents, and Secants.

40 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N.Co-Secant.	
30	6494480	7604060	8540807	11708496	13150870	15397690	30
31	6496692	7602170	8545839	11701601	13154139	15392449	29
32	6498903	7600280	8550873	11694712	13157410	15387212	28
33	6501114	7598389	8555910	11687827	13160684	15381980	27
34	6503324	7596498	8560950	11680947	13163961	15376752	26
35	6505533	7594606	8565992	11674071	13167241	15371530	25
36	6507742	7592713	8571037	11667200	13170523	15366312	24
37	6509950	7590820	8576084	11660334	13173808	15361100	23
38	6512158	7588926	8581133	11653472	13177096	15355892	22
39	6514366	7587031	8586185	11646615	13180386	15350689	21
40	6516572	7585136	8591240	11639763	13183679	15345491	20
41	6518778	7583240	8596297	11632916	13186975	15340297	19
42	6520984	7581343	8601357	11626073	13190274	15335109	18
43	6523189	7579446	8606419	11619234	13193576	15329925	17
44	6525394	7577548	8611484	11612400	13196881	15324746	16
45	6527598	7575650	8616551	11605571	13200188	15319572	15
46	6529801	7573751	8621621	11598747	13203498	15314403	14
47	6532004	7571851	8626693	11591927	13206811	15309238	13
48	6534206	7569950	8631768	11585111	13210126	15304078	12
49	6536408	7568049	8636846	11578301	13213444	15298923	11
50	6538609	7566147	8641926	11571495	13216765	15293773	10
51	6540810	7564245	8647009	11564693	13220089	15288627	9
52	6543010	7562342	8652094	11557896	13223416	15283487	8
53	6545209	7560439	8657181	11551104	13226745	15278351	7
54	6547408	7558535	8662271	11544316	13230077	15273219	6
55	6549606	7556630	8667364	11537532	13233412	15268093	5
56	6551804	7554724	8672460	11530754	13236750	15262971	4
57	6554001	7552818	8677558	11523979	13240091	15257854	3
58	6556198	7550911	8682659	11517210	13243435	15252741	2
59	6558394	7549004	8687762	11510445	13246781	15247634	1
60	6560590	7547096	8692868	11503684	13250130	15242531	0
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N.Tangent.	N.Co-Secant.	N. Secant.	M

49 DEGREES.

40 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.8125444	9.8810455	9.9314989	10.0685011	10.1189545	10.1874556	30
31	9.8126923	9.8809376	9.9317547	10.0682453	10.1190624	10.1873077	29
32	9.8128401	9.8808296	9.9320105	10.0679895	10.1191704	10.1871599	28
33	9.8129878	9.8807215	9.9322662	10.0677338	10.1192785	10.1870122	27
34	9.8131354	9.8806134	9.9325220	10.0674780	10.1193866	10.1868645	26
35	9.8132829	9.8805052	9.9327777	10.0672223	10.1194948	10.1867171	25
36	9.8134303	9.8803970	9.9330334	10.0669666	10.1196030	10.1865697	24
37	9.8135777	9.8802887	9.9332890	10.0667110	10.1197113	10.1864223	23
38	9.8137250	9.8801803	9.9335446	10.0664554	10.1198197	10.1862750	22
39	9.8138721	9.8800719	9.9338003	10.0661997	10.1199281	10.1861279	21
40	9.8140192	9.8799634	9.9340559	10.0659441	10.1200366	10.1859808	20
41	9.8141662	9.8798548	9.9343114	10.0656886	10.1201452	10.1858338	19
42	9.8143131	9.8797462	9.9345670	10.0654330	10.1202538	10.1856869	18
43	9.8144600	9.8796375	9.9348225	10.0651775	10.1203625	10.1855400	17
44	9.8146067	9.8795287	9.9350780	10.0649220	10.1204713	10.1853933	16
45	9.8147534	9.8794199	9.9353335	10.0646665	10.1205801	10.1852465	15
46	9.8148999	9.8793110	9.9355889	10.0644111	10.1206890	10.1851001	14
47	9.8150464	9.8792021	9.9358444	10.0641556	10.1207979	10.1849536	13
48	9.8151928	9.8790930	9.9360998	10.0639002	10.1209070	10.1848072	12
49	9.8153391	9.8789840	9.9363552	10.0636448	10.1210160	10.1846609	11
50	9.8154854	9.8788748	9.9366105	10.0633895	10.1211252	10.1845146	10
51	9.8156315	9.8787656	9.9368659	10.0631341	10.1212344	10.1843685	9
52	9.8157776	9.8786563	9.9371212	10.0628788	10.1213437	10.1842224	8
53	9.8159235	9.8785470	9.9373765	10.0626235	10.1214530	10.1840765	7
54	9.8160694	9.8784376	9.9376318	10.0623682	10.1215624	10.1839306	6
55	9.8162152	9.8783281	9.9378871	10.0621129	10.1216719	10.1837848	5
56	9.8163609	9.8782186	9.9381423	10.0618577	10.1217814	10.1836391	4
57	9.8165066	9.8781090	9.9383975	10.0616025	10.1218910	10.1834934	3
58	9.8166521	9.8779994	9.9386527	10.0613473	10.1220006	10.1833479	2
59	9.8167975	9.8778896	9.9389079	10.0610921	10.1221104	10.1832025	1
60	9.8169429	9.8777799	9.9391631	10.0608369	10.1222201	10.1830571	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

49 DEGREES.

A Table of the Latitude and Longitude of the Chiefeſt Places of the World.

The Places Names.	North Latitud. D.	North Latitud. M.	West Longit. D.	West Longit. M.	The Places Names.	North Latitud. D.	North Latitud. M.	West Longit. D.	West Longit. M.
Mevis	27	27	71	04	Yamatta	22	32	67	49
Sigvatro	26	18	68	45	Soamia	24	20	68	50
Guatro	25	47	68	00	Javaqua	25	10	71	30
Guamina	25	15	67	53	Yamia	24	22	70	10
Tiango	24	33	66	30	*St.* John	18	30	60	42
Guanahimo	23	50	66	39	Santa Cruce	17	42	59	18
Mayagnana	23	05	66	51	Anguilla	18	48	57	00
Caycoſs	22	05	64	31	*St.* Martin	18	35	56	47
Amiana	21	40	64	38	*St.* Bartholomew	18	15	56	33
Inagua	21	19	67	03	Barbada	17	18	55	39
Antego	16	32	54	52	*St.* Vincent	12	50	54	2[illegible]
Daſſijada	16	00	54	36	Guardadupa	16	00	55	3[illegible]
Marigallatita	15	41	55	26	Monſerrat	16	20	55	4[illegible]
Dominica	15	00	55	05	Maves	17	00	56	2[illegible]
Mattalina	14	20	54	44	*St.* Chriſtophers	17	30	56	4[illegible]
St. Lucia	13	30	54	43	Iſland Devas	15	57	57	2[illegible]
Barbadus	13	10	52	58	Iſland Blanco	12	20	56	5[illegible]
Tobago	11	12	53	06	Marg[illegible]ita	11	28	56	3[illegible]
Point Degallaia	10	45	53	31	Turtuga	11	30	57	4[illegible]
Granada	12	10	54	32	Iſland Derickilla	12	19	58	0[illegible]

41 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	6560590	7547096	8692868	11503684	13250130	15242531	60
1	6562785	7545187	8697975	11496928	13253482	15237433	59
2	6564980	7543278	8703087	11490176	13256837	15232339	58
3	6567174	7541363	8708200	11483429	13260194	15227250	57
4	6569367	7539457	8713316	11476687	13263554	15222166	56
5	6571560	7537546	8718435	11469949	13266918	15217087	55
6	6573752	7535634	8723556	11463215	13270284	15212012	54
7	6575944	7533721	8728680	11456485	13273653	15206942	53
8	6578135	7531808	8733806	11449762	13277025	15201876	52
9	6580326	7529894	8738935	11443041	13280399	15196815	51
10	6582516	7527980	8744067	11436326	13283776	15191759	50
11	6584706	7526065	8749201	11429615	13287156	15186708	49
12	6586895	7524149	8754338	11422908	13290539	15181661	48
13	6589083	7522233	8759478	11416206	13293925	15176619	47
14	6591271	7520316	8764620	11409508	13297314	15171581	46
15	6593458	7518398	8769765	11402815	13300706	15166548	45
16	6595645	7516480	8774912	11396126	13304100	15161520	44
17	6597831	7514561	8780062	11389441	13307497	15156496	43
18	6600017	7512641	8785215	11382761	13310897	15151477	42
19	6602202	7510721	8790370	11376085	13314300	15146462	41
20	6604386	7508800	8795528	11369414	13317706	15141452	40
21	6606570	7506879	8800689	11362747	13321115	15136447	39
22	6608753	7504957	8805852	11356085	13324527	15131446	38
23	6610936	7503034	8811018	11349427	13327942	15126450	37
24	6613118	7501111	8816186	11342773	13331359	15121459	36
25	6615300	7499187	8821357	11336124	13334779	15116472	35
26	6617481	7497262	8826531	11329479	13338202	15111489	34
27	6619662	7495337	8831707	11322839	13341628	15106511	33
28	6621842	7493411	8836886	11316203	13345057	15101538	32
29	6624022	7491484	8842068	11309571	13348489	15096569	31
30	6626201	7489557	8847253	11302944	13351924	15091605	30
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

48 DEGREES.

41 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.8169429	9.8777799	9.9391631	10.0608369	10.1222201	10.1830571	60
1	9.8170882	9.8776700	9.9394182	10.0605818	10.1223300	10.1829118	59
2	9.8172334	9.8775601	9.9396733	10.0603267	10.1224399	10.1827666	58
3	9.8173785	9.8774501	9.9399284	10.0600716	10.1225499	10.1826215	57
4	9.8175235	9.8773401	9.9401835	10.0598165	10.1226599	10.1824765	56
5	9.8176685	9.8772300	9.9404385	10.0595615	10.1227700	10.1823315	55
6	9.8178133	9.8771198	9.9406936	10.0593064	10.1228802	10.1821867	54
7	9.8179581	9.8770096	9.9409486	10.0590514	10.1229904	10.1820419	53
8	9.8181028	9.8768993	9.9412036	10.0587964	10.1231007	10.1818972	52
9	9.8182474	9.8767889	9.9414585	10.0585415	10.1232111	10.1817526	51
10	9.8183919	9.8766785	9.9417135	10.0582865	10.1233215	10.1816081	50
11	9.8185364	9.8765680	9.9419684	10.0580316	10.1234320	10.1814636	49
12	9.8186807	9.8764574	9.9422233	10.0577767	10.1235426	10.1813193	48
13	9.8188250	9.8763468	9.9424782	10.0575218	10.1836532	10.1811750	47
14	9.8189692	9.8762361	9.9427331	10.0572669	10.1237639	10.1810308	45
15	9.8191133	9.8761253	9.9429879	10.0570121	10.1238747	10.1808867	45
16	9.8192573	9.8760145	9.9432428	10.0567572	10.1239855	10.1807427	44
17	9.8194012	9.8759036	9.9434976	10.0565024	10.1240964	10.1805988	43
18	9.8195450	9.8757927	9.9437524	10.0562476	10.1242073	10.1804550	42
19	9.8196888	9.8756816	9.9440072	10.0559928	10.1243184	10.1803112	41
20	9.8198325	9.8755706	9.9442619	10.0557381	10.1244294	10.1801675	40
21	9.8199761	9.8754594	9.9445166	10.0554834	10.1245406	10.1800239	39
22	9.8201196	9.8753482	9.9447714	10.0552286	10.1246518	10.1798804	38
23	9.8202630	9.8752369	9.9450261	10.0549739	10.1247631	10.1797370	37
24	9.8204063	9.8751256	9.9452807	10.0547193	10.1248744	10.1795937	36
25	9.8205496	9.8750142	9.9455354	10.0544646	10.1249858	10.1794504	35
26	9.8206927	9.8749027	9 9457900	10.0542100	10.1250973	10.1793073	34
27	9.8208358	9.8747912	9.9460447	10.0939553	10.1252088	10.1791642	33
28	9.8209788	9.8746795	9.9462993	10.0537007	10.1253205	10.1790212	32
29	9.8211217	9.8745679	9.9465539	10.0534461	10.1254321	10.1788783	31
30	9.8212646	9.8744561	9.9468084	10.0531916	10.1255439	10.1787354	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

48 DEGREES.

A Table of the Latitude and Longitude of the Chiefest Places of the World.

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
Boca	12	19	58	53
Island Deavos	12	29	59	22
Bonoga	12	32	60	54
Quissa	12	25	60	39
Moagos	12	20	61	55
East end of Hispaniola	18	47	62	28
Middle of Hispaniola	18	30	64	58
West end of Hispaniola	18	25	68	26
East end of Jamaica	18	00	71	58
Jamaica *Harbour*	18	15	72	57

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
West end of Jamaica	18	38	74	57
The East end of Cuba	22	00	75	56
Caimanis	19	41	77	41
Grand Caiman	19	21	78	45
Santavilla	17	28	77	50
Mosquito	14	50	76	04
Guanabo	16	33	81	19
Guanabimo	16	10	83	04
Cozumal	19	25	84	56
Lasalleeranas	22	00	87	58

The Places Names.	North Latitud D.	M.	East Longit. D.	M.
The Island Delas	23	30	91	58
Abraio	25	50	94	00
Labarmaia	22	55	93	16
Island Dearanas	22	36	93	14
Triango	21	23	93	05
Zarka	20	50	93	00
The Island of Prondanco	13	27	81	16
St. Andrea	12	42	80	57

The Sea-Coasts of Brasilia.

The Places Names.	North Latitud. D.	M.	East Longit. D.	M.
The River Amazons	00	00	41	30
The Island of St. Paul	00	55	14	36
The Island of Ascension	07	48	20	06
Cape Blanco	02	25	22	29
Island Rocas	03	42	17	16
Island Farnando	03	40	15	16
Abratho	05	00	17	56

41 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	6626201	7489557	8847253	11302944	13351924	15091605	30
31	6628379	7487629	8852440	11296321	13355362	15086645	29
32	6630557	7485701	8857630	11289702	13358803	15081690	28
33	6632734	7483772	8862822	11283088	13362246	15076739	27
34	6634911	7481842	8868017	11276478	13365692	15071793	26
35	6637087	7479912	8873215	11269872	13369141	15066852	25
36	6639262	7477981	8878416	11263271	13372594	15061915	24
37	6641437	7476049	8883620	11256674	13376049	15056982	23
38	6643611	7474117	8888826	11250081	13379507	15052054	22
39	6645785	7472184	8894034	11243493	13382968	15047131	21
40	6647959	7470251	8899245	11236909	13386432	15042211	20
41	6650132	7468317	8904459	11230329	13389899	15037297	19
42	6652304	7466382	8909675	11223754	13393369	15032387	18
43	6654475	7464446	8914894	11217183	13396842	15027481	17
44	6656646	7462510	8920116	11210616	13400317	15022580	16
45	6658817	7460574	8925341	11204053	13403795	15017683	15
46	6660987	7458637	8930569	11197495	13407276	15012791	14
47	6663156	7456699	8935799	11190941	13410761	15007903	13
48	6665325	7454760	8941032	11184391	13414248	15003020	12
49	6667493	7452821	8946268	11177846	13417738	14998141	11
50	6669661	7450881	8951506	11171305	13421232	14993267	10
51	6671828	7448940	8956747	11164768	13424728	14988397	9
52	6673994	7446999	8961991	11158235	13428227	14983531	8
53	6676160	7445057	8967238	11151706	13431729	14978670	7
54	6678326	7443115	8972487	11145182	13435234	14973813	6
55	6680491	7441172	8977739	11138662	13438742	14968961	5
56	6682655	7439229	8982994	11132146	13442253	14964113	4
57	6684818	7437285	8988252	11125635	13445767	14959270	3
58	6686981	7435340	8993512	11119127	13449284	14954430	2
59	6689144	7433394	8998775	11112624	13452804	14949596	1
60	6691306	7431448	9004041	11106125	13456327	14944765	0
	N. Co-Sine	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co-Secant.	N. Secant.	M

48 DEGREES.

A Table of the Latitude and Longitude

The Places Names.	South Latitud. D.	M.	West Longit. D.	M.	The Places Names.	South Latitud. D.	M.	West Longit. D.	M.
Cape *St.* Raphali	06	10	19	36	Island de Martin	19	00	08	03
Cape *St.* Augustin	08	25	18	28	Island de Pidos	21	52	05	51
River *St.* Mignal	09	30	19	01	Cape *St.* Toma	21	47	23	38
The River Roal	11	21	20	41	Cape Frio	22	52	24	43
River Gianda	14	49	22	06	Cape *St.* Maria	35	00	37	11
Cape de Abeotho	17	52	21	42	River de Platta	35	50	45	52
St. Harbara	18	11	21	06	Port *St.* Juliano	50	00	52	30
Island Ascension	17	19	17	01	*The* Streights *of* Magellane	53	30	56	30
Trinidada	19	50	14	24					
St. Maria Dagasta	19	38	12	14	Cape de Sancto Spirito	52	20	58	30

41 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.8212646	9.8744561	9.9468084	10.0531916	10.1255439	10.1787354	30
31	9.8214073	9.8743443	9.9470630	10.0529370	10.1256557	10.1785927	29
32	9.8215500	9.8742325	9.9473175	10.0526825	10.1257675	10.1784500	28
33	9.8216926	9.8741205	9.9475720	10.0524280	10.1258795	10.1783074	27
34	9.8218351	9.8740085	9.9478265	10.0521735	10.1259915	10.1781649	26
35	9.8219775	9.8738965	9.9480810	10.0519190	10.1261035	10.1780225	25
36	9.8221198	9.8737844	9.9483355	10.0516645	10.1262156	10.1778802	24
37	9.8222621	9.8736722	9.9485899	10.0514101	10.1263278	10.1777379	23
38	9.8224042	9.8735599	9.9488443	10.0511557	10.1264401	10.1775958	22
39	9.8225463	9.8734476	9.9490987	10.0509013	10.1265524	10.1774537	21
40	9.8226883	9.8733352	9.9493531	10.0506469	10.1266648	10.1773117	20
41	9.8228302	9.8732227	9.9496075	10.0503925	10.1267773	10.1771698	19
42	9.8229721	9.8731102	9.9498619	10.0501381	10.1268898	10.1770279	18
43	9.8231138	9.8729976	9.9501162	10.0498838	10.1870024	10.1776862	17
44	9.8232555	9.8728849	9.9503705	10.0496295	10.1271151	10.1767445	16
45	9.8233971	9.8727722	9.9506248	10.0493752	10.1272278	10.1766025	15
46	9.8235386	9.8726594	9.9508791	10.0491209	10.1273406	10.1764614	14
47	9.8236800	9.8725466	9.9511334	10.0488666	10.1274534	10.1763200	13
48	9.8238213	9.8724337	9.9513876	10.0486124	10.1275663	10.1761787	12
49	9.8239626	9.8723207	9.9516419	10.0483581	10.1276793	10.1760374	11
50	9.8241037	9.8722076	9.9518961	10.0481039	10.1277924	10.1758963	10
51	9.8242448	9.8720945	9.9521503	10.0478497	10.1279055	10.1757552	9
52	9.8243858	9.8719813	9.9524045	10.0475955	10.1280187	10.1756142	8
53	9.8245267	9.8718681	9.9526587	10.0473413	10.1281319	10.1754733	7
54	9.8246676	9.8717548	9.9529128	10.0470872	10.1282452	10.1753324	6
55	9.8248083	9.8716414	9.9531670	10.0468330	10.1283586	10.1751917	5
56	9.8249490	9.8715279	9.9534211	10.0465789	10.1284721	10.1750510	4
57	9.8250896	9.8714144	9.9536752	10.0463248	10.1285856	10.1749104	3
58	9.8252301	9.8713008	9.9539293	10.0460707	10.1286992	10.1747699	2
59	9.8253705	9.8711872	9.9541834	10.0458166	10.1288128	10.1746295	1
60	9.8255109	9.8710735	9.9544374	10.0455626	10.1289265	10.1744891	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

48 DEGREES.

of the Chiefest Places of the World.

The Places Names.	South. Latitud. D.	M.	West. Longit. D.	M.	The Places Names.	South Latitud. D.	M.	West Longit. D.	M.
Cape Victoria, *West end of the* Streights	52	30	65	40	Nova Albion, *or* New-England, *in the South Sea, the back side of it.*	46	00	162	30
Lima Cape	12	00	80	30					
Cape Guya, Cape Blanco	06	10	85	30					
Cape *St.* Francisco	01	30	80	30	Cape de Fortuna (Aniar. fra.	55	30	170	*E.* 0
Cape *St.* Frances	*North*		*West.*						
Point de bon matre	07	30	80	00	Insulæ Salamonis	*So. Lat.*		*W. Lon.*	
Nombre de Dios. *W. Sea.*	10	00	77	30	Nombre de Jesus	05	50	169	30
					Tapan Insule	36 *N*	00	153	*E.* 0
					Cape de Buena Desco	01 *S.*	00	155	0

42 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	6691306	7431448	9004041	11106125	13456327	14944765	60
1	6693467	7429501	9009309	11099630	13459853	14939940	59
2	6695628	7427554	9014583	11093140	13463382	14935118	58
3	6697788	7425606	9019854	11086653	13466914	14930301	57
4	6699948	7423657	9025131	11080171	13470449	14925488	56
5	6702107	7421708	9030411	11073693	13473987	14920680	55
6	6704266	7419758	9035694	11067219	13477528	14915875	54
7	6706424	7417808	9040979	11060750	13481072	14911076	53
8	6708582	7415857	9046267	11054284	13484619	14906280	52
9	6710739	7413905	9051558	11047823	13488169	14901489	51
10	6712895	7411953	9056851	11041365	13491721	14896703	50
11	6715051	7410000	9062147	11034912	13495277	14891920	49
12	6717206	7408046	9067446	11028463	13498836	14887142	48
13	6719361	7406092	9072748	11022019	13502398	14882369	47
14	6721515	7404137	9078053	11015578	13505963	14877599	46
15	6723668	7402181	9083360	11009141	13509531	14872834	45
16	6725821	7400225	9088671	11002709	13513102	14868073	44
17	6727973	7398268	9093984	10996281	13516676	14863317	43
18	6730125	7396311	9099300	10989856	13520254	14858565	42
19	6732276	7394353	9104619	10983436	13523834	14853817	41
20	6734427	7392394	9109941	10977020	13527417	14849073	40
21	6736577	7390435	9115265	10970608	13531003	14844334	39
22	6738727	7388475	9120592	10964201	13534593	14839599	38
23	6740876	7386515	9125922	10957797	13538186	14834868	37
24	6743024	7384554	9131255	10951397	13541781	14830142	36
25	6745172	7382592	9136591	10945002	13545379	14825420	35
26	6747319	7380629	9141929	10938610	13548980	14820702	34
27	6749466	7378666	9147270	10932223	13552585	14815988	33
28	6751612	7376702	9152615	10925840	13556193	14811278	32
29	6753757	7374738	9157962	10919460	13559803	14806573	31
30	6755902	7372773	9163312	10913085	13563417	14801872	30
	N. Co-Sine	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co.Secant.	N. Secant.	M

47 DEGREES.

42 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.8255109	9.8710735	9.9544374	10.0455626	10.1289265	10.1744891	60
1	9.8256512	9.8709597	9.9546915	10.0453085	10.1290403	10.1743488	59
2	9.8257913	9.8708458	9.9549455	10.0450545	10.1291542	10.1742087	58
3	9.8259314	9.8707319	9.9551995	10.0448005	10.1292681	10.1740686	57
4	9.8260715	9.8706179	9.9554535	10.0445465	10.1293821	10.1739285	56
5	9.8262114	9.8705039	9.9557075	10.0442925	10.1294961	10.1737886	55
6	9.8263512	9.8703898	9.9559615	10.0440385	10.1296102	10.1736488	54
7	9.8264910	9.8702756	9.9562154	10.0437846	10.1297244	10.1735090	53
8	9.8266307	9.8701613	9.9564694	10.0435306	10.1298387	10.1733693	52
9	9.8267703	9.8700470	9.9567233	10.0432767	10.1299530	10.1732297	51
10	9.8269098	9.8699326	9.9569772	10.0430228	10.1300674	10.1730902	50
11	9.8270493	9.8698182	9.9572311	10.0427689	10.1301818	10.1729507	49
12	9.8271887	9.8697037	9.9574850	10.0425150	10.1302963	10.1728113	48
13	9.8273279	9.8695891	9.9577389	10.0422611	10.1304109	10.1726721	47
14	9.8274671	9.8694741	9.9579927	10.0420073	10.1305256	10.1725329	46
15	9.8276063	9.8693597	9.9582465	10.0417535	10.1306403	10.1723937	45
16	9.8277453	9.8692449	9.9585004	10.0414996	10.1307551	10.1722547	44
17	9.8278843	9.8691301	9.9587542	10.0412458	10.1308699	10.1721157	43
18	9.8280231	9.8690152	9.9590080	10.0409920	10.1309848	10.1719769	42
19	9.8281619	9.8689002	9.9592618	10.0407382	10.1310998	10.1718381	41
20	9.8283006	9.8687851	9.9595155	10.0404845	10.1312149	10.1716994	40
21	9.8284393	9.8686700	9.9597693	10.0402307	10.1313300	10.1715607	39
22	9.8285778	9.8685548	9.9600230	10.0399770	10.1314452	10.1714222	38
23	9.8287163	9.8684396	9.9602767	10.0397233	10.1315604	10.1712837	37
24	9.8288547	9.8683242	9.9605305	10.0394695	10.1316758	10.1711453	36
25	9.8289930	9.8682088	9.9607842	10.0392158	10.1317912	10.1710070	35
26	9.8291312	9.8680934	9.9610378	10.0389622	10.1319066	10.1708688	34
27	9.8292694	9.8679779	9.9612915	10.0387085	10.1320221	10.1707306	33
28	9.8294075	9.8678623	9.9615452	10.0384548	10.1321377	10.1705925	32
29	9.8295454	9.8677466	9.9617988	10.0382012	10.1322534	10.1704546	31
30	9.8296833	9.8676309	9.9620525	10.0379475	10.1323691	10.1703167	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

47 DEGREES.

A Table of the Latitude and Longitude of the Chiefest Places of the World.

The East-India Islands.

The Places Names.	*North Latitud.* D.	M.	*East Longit.* D.	M.
Hipon Island	06	45	125	20
Bantam, East-India	06	15	125	34
Jamba Islands	01	49	125	25
South end of Sumatra	05	52	125	48
Middle of Sumatra	01	30	120	49
North end of Sumatra	05	28	116	35
Gomaspala	05	40	116	29

The Places Names.	*North Latitud.* D.	M.	*East Longit.* D.	M.
Niobar	07	00	115	04
Island Desombro	08	00	114	54
Island Rusta	09	50	114	33
Quarinibar	11	10	114	44
Chitra Andomaio	12	00	114	41
Island Dandemajo	13	00	114	39
Island Decocoss	14	30	115	12
Celloan	07	50	98	39
Doda Safia	09	40	93	02
Andaio	11	30	90	51

The Places Names.	*South Latitud* D.	M.	*East Longit.* D.	M.
Garine	10	50	90	56
Moique	09	05	91	29
Cuballa	08	53	91	07
Island de Prosol	10	23	90	55
Island de Zocha	11	12	90	45
Chorebaman	12	32	87	55
Sucatra	12	18	74	01
Abdelcari	12	12	71	44
Apoluaria	09 S.	20	90	50

The Places Names.	*South Latitud.* D.	M.	*East Longit.* D.	M.
Adu	05	39	88	50
Degomo	02	40	87	35
Piedros Blancho	06	10	76	55
Diego gratiosa	08	30	78	15
Set Hermanas	03	02	70	25
Domes Caicuhas	03	21	65	24
Island Quellallo	03	40	64	20
De Almiranta	03	57	63	28
Agnalaga	09	00	66	15

42 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	6755902	7372773	9163312	10913085	13563417	14801872	30
31	6758046	7370808	9168665	10906714	13567034	14797176	29
32	6760190	7368842	9174020	10900347	13570654	14792483	28
33	6762333	7366875	9179379	10893983	13574277	14787795	27
34	6764476	7364907	9184740	10887624	13577903	14783111	26
35	6766618	7362939	9190104	10881269	13581532	14778431	25
36	6768760	7360971	9195471	10874918	13585164	14773755	24
37	6770901	7359002	9200841	10868571	13588800	14769084	23
38	6773041	7357032	9206214	10862228	13592438	14764417	22
39	6775181	7355061	9211590	10855889	13596080	14759754	21
40	6777320	7353090	9216968	10849554	13599725	14755095	20
41	6779459	7351118	9222350	10843223	13603372	14750440	19
42	6781597	7349146	9227734	10836896	13607023	14745790	18
43	6783734	7347173	9233122	10830573	13610677	14741144	17
44	6785871	7345199	9238512	10824254	13614334	14736501	16
45	6788007	7343225	9243905	10817939	13617995	14731864	15
46	6790143	7341250	9249301	10811628	13621658	14727230	14
47	6792278	7339275	9254700	10805321	13625324	14722600	13
48	6794413	7337299	9260101	10799018	13628994	14717975	12
49	6796547	7335322	9265506	10792718	13632667	14713353	11
50	6798681	7333345	9270914	10786423	13636343	14708736	10
51	6800814	7331367	9276324	10780132	13640022	14704123	9
52	6802946	7329388	9281738	10773844	13643704	14699514	8
53	6805078	7327409	9287154	10767561	13647389	14694910	7
54	6807209	7325429	9292573	10761282	13651078	14690309	6
55	6809339	7323448	9297996	10755006	13654770	14685713	5
56	6811469	7321467	9303421	10748734	13658464	14681120	4
57	6813599	7319485	9308849	10742467	13662162	14676532	3
58	6815728	7317503	9314280	10736203	13665863	14671948	2
59	6817856	7315520	9319714	10729943	13669567	14667368	1
60	6819984	7313537	9325151	10723687	13673275	14662792	0
	N. Co-Sine	N. Sine.	N. Co-Tang	N. Tangent.	N. Co Secant.	N. Secant.	M

47 DEGREES.

42 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.8296833	9.8676309	9.9620525	10.0379475	10.1323691	10.1703167	30
31	9.8298212	9.8675151	9.9623061	10.0376939	10.1324849	10.1701788	29
32	9.8299589	9.8673992	9.9625597	10.0374403	10.1326008	10.1700411	28
33	9.8300966	9.8672833	9.9628133	10.0371867	10.1327167	10.1699034	27
34	9.8302342	9.8671673	9.9630669	10.0369331	10.1328327	10.1697658	26
35	9.8303717	9.8670512	9.9633204	10.0366795	10.1329488	10.1696283	25
36	9.8305091	9.8669351	9.9635740	10.0364260	10.1330649	10.1694909	24
37	9.8306464	9.8668189	9.9638275	10.0361725	10.1331811	10.1693536	23
38	9.8307837	9.8667026	9.9640811	10.0359189	10.1332974	10.1692163	22
39	9.8309209	9.8665863	9.9643346	10.0356654	10.1334137	10.1690791	21
40	9.8310580	9.8664699	9.9645881	10.0354119	10.1335301	10.1689420	20
41	9.8311950	9.8663534	9.9648416	10.0351584	10.1336466	10.1688050	19
42	9.8313320	9.8662369	9.9650951	10.0349049	10.1337631	10.1686680	18
43	9.8314688	9.8661203	9.9653486	10.0346514	10.1338797	10.1685312	17
44	9.8316056	9.8660036	9.9656020	10.0343980	10.1339964	10.1683944	16
45	9.8317423	9.8658868	9.9658555	10.0341445	10.1341132	10.1682577	15
46	9.8318789	9.8657700	9.9661089	10.0338911	10.1342300	10.1681211	14
47	9.8320155	9.8656531	9.9663623	10.0336377	10.1343469	10.1679845	13
48	9.8321519	9.8655362	9.9666157	10.0333843	10.1344638	10.1678481	12
49	9.8322883	9.8654192	9.9668692	10.0331308	10.1345808	10.1677117	11
50	9.8324245	9.8653021	9.9671225	10.0328775	10.1346979	10.1675754	10
51	9.8325609	9.8651849	9.9673759	10.0326241	10.1348151	10.1674391	9
52	9.8326970	9.8650677	9.9676293	10.0323707	10.1349323	10.1673030	8
53	9.8328331	9.8649504	9.9678827	10.0321173	10.1350496	10.1671669	7
54	9.8329691	9.8648331	9.9681360	10.0318640	10.1351669	10.1670309	6
55	9.8331050	9.8647156	9.9683893	10.0316107	10.1352844	10.1668950	5
56	9.8332408	9.8645981	9.9686427	10.0313573	10.1354019	10.1667592	4
57	9.8333766	9.8644806	9.9688960	10.0311040	10.1355194	10.1666234	3
58	9.8335122	9.8643629	9.9691493	10.0308507	10.1356371	10.1664878	2
59	9.8336478	9.8642452	9.9694026	10.0305974	10.1357548	10.1663522	1
60	9.8337833	9.8641275	9.9696559	10.0303441	10.1358725	10.1662167	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

47 DEGREES.

A Table of the Latitude and Longitude of the Chiefest Places of the World.

The Places Names.	South Latitud. D.	M.	East Longit. D.	M.
Asdore Has	09	05	65	02
John. de Nava	09	00	63	26
Cosmobodo	09	40	61	52
Donatall	08	20	59	57
Aignos	09	30	58	18
John de Comoro	09	00	57	20
Pemba	05	09	53	30
Zanziba	06	26	53	35
Mansia	07	50	53	08

The Places Names.	South Latitud. D.	M.	East Longit. D.	M.
John Demiz	10	48	54	24
Comoro	11	20	55	48
Monhalla	12	11	56	25
Foanna	12	09	57	03
Mayatta	12	40	57	55
St. Christopher	14	30	56	03
John de Nova	17	20	55	29
Bassas de India	22	10	55	22

The Places Names.	South Latitud. D.	M.	East Longit. D.	M.
North end of St. Laurence	25	37	60	54
St. Apohima	20	50	55	54
Domscaicahas	20	50	66	54
Morosflas	20	20	68	44
Dosgarias	15	20	70	43
St. Branda	17	13	74	44
England's Forest	20	50	74	14
Diego Roize	20	05	75	54

The Places Names.	South Latitud. D.	M.	East Longit. D.	M.
John de Lisbone	25	24	68	32
Romoras	28	19	81	21

The Sea-Coast on the Main Continent in the East-India.

Malacca	01	N.41	116	14
Queda	06	47	117	44

43 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N.Co-Secant.	
0	6819984	7313537	9325151	10723687	13673275	14662792	60
1	6822111	7311553	9330591	10717435	13676985	14658220	59
2	6824237	7309568	9336034	10711187	13680699	14653652	58
3	6826363	7307583	9341479	10704943	13684416	14649088	57
4	6828488	7305597	9346928	10698702	13688136	14644529	56
5	6830613	7303610	9352380	10692466	13691859	14639973	55
6	6832737	7301623	9357834	10686233	13695586	14635422	54
7	6834861	7299635	9363292	10680004	13699315	14630875	53
8	6836984	7297646	9368753	10673779	13703048	14626331	52
9	6839107	7295657	9374216	10667558	13706784	14621792	51
10	6841229	7293667	9379683	10661341	13710523	14617257	50
11	6843350	7291677	9385152	10655128	13714266	14612726	49
12	6845471	7289686	9390625	10648918	13718011	14608198	48
13	6847591	7287694	9396101	10642713	13721760	14603675	47
14	6849711	7285702	9401579	10636511	13725512	14599156	46
15	6851830	7283709	9407061	10630313	13729268	14594641	45
16	6853948	7281716	9412545	10624119	13733026	14590130	44
17	6856066	7279722	9418033	10617929	13736788	14585623	43
18	6858183	7277727	9423523	10611742	13740553	14581120	42
19	6860300	7275732	9429017	10605560	13744321	14576621	41
20	6862416	7273736	9434513	10599381	13748092	14572127	40
21	6864532	7271740	9440013	10593206	13751867	14567636	39
22	6866647	7269743	9445516	10587034	13755645	14563149	38
23	6868761	7267745	9451021	10580867	13759426	14558666	37
24	6870875	7265747	9456530	10574703	13763210	14554187	36
25	6872988	7263748	9462042	10568544	13766998	14549712	35
26	6875101	7261748	9467556	10562388	13770789	14545241	34
27	6877213	7259748	9473074	10556235	13774583	14540774	33
28	6879324	7257747	9478595	10550087	13778380	14536311	32
29	6881435	7255746	9484119	10543942	13782181	14531852	31
30	6883545	7253744	9489646	10537801	13785985	14527397	30
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N.Tangent.	N.Co-Secant.	N. Secant.	M

46 DEGREES.

A Table of the Latitude and Longitude

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.	The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
River de Care	10	45	118	54	Mongalar	12	40	97	19
River Bengale	22	09	121	33	Dodall	17	01	98	55
Aicopoir	20	19	112	39	Goa	14	40	97	01
Samnabron	18	30	108	52	Chaul	18	10	98	51
Arme Gon	14	35	100	27	Calecut *in* Eaſt-India	11	30	92	58
Naga Patam	11	21	99	50	Macao *in the K. of* Pegu	19	30	112	40
Cape Comorin	07	50	97	39	Domon	11	54	99	01
Cochin	09	40	97	20	Surat	21	00	99	36
Callant	10	48	97	27	Dio	20	48	96	57

43 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.8337833	9.8641275	9.9696559	10.0303441	10.1358725	10.1662167	60
1	9.8339188	9.8640096	9.9699091	10.0300909	10.1359904	10.1960812	59
2	9.8340541	9.8638917	9.9701624	10.0298376	10.1361083	10.1659459	58
3	9.8341894	9.8637737	9.9704157	10.0295843	10.1362263	10.1658106	57
4	9.8343246	9.8636557	9.9706689	10.0293311	10.1363443	10.1656754	56
5	9.8344597	9.8635376	9.9709221	10.0290779	10.1364624	10.1655403	55
6	9.8345948	9.8634194	9.9711754	10.0288246	10.1365806	10.1654052	54
7	9.8347297	9.8633011	9.9714286	10.0285714	10.1366989	10.1652703	53
8	9.8348646	9.8631828	9.9716818	10.0283182	10.1368172	10.1651354	52
9	9.8349994	9.8630644	9.9719350	10.0280650	10.1369356	10.1650006	51
10	9.8351341	9.8629460	9.9721882	10.0278118	10.1370540	10.1648659	50
11	9.8352688	9.8628274	9.9724413	10.0275587	10.1371726	10.1647312	49
12	9.8354033	9.8627088	9.9726945	10.0273055	10.1372912	10.1645967	48
13	9.8355378	9.8625902	9.9729477	10.0270523	10.1374098	10.1644622	47
14	9.8356722	9.8624714	9.9732008	10.0267992	10.1375286	10.1643278	46
15	9.8358066	9.8623526	9.9734539	10.0265461	10.1376474	10.1641934	45
16	9.8359408	9.8622338	9.9737071	10.0262929	10.1377662	10.1640592	44
17	9.8360750	9.8621148	9.9739602	10.0260398	10.1378852	10.1639250	43
18	9.8362091	9.8619958	9.9742133	10.0257867	10.1380042	10.1637909	42
19	9.8363431	9.8618767	9.9744664	10.0255336	10.1381233	10.1636569	41
20	9.8364771	9.8617576	9.9747195	10.0252805	10.1382424	10.1635229	40
21	9.8366109	9.8616383	9.9749726	10.0250274	10.1383617	10.1633891	39
22	9.8367447	9.8615190	9.9752257	10.0247743	10.1384810	10.1632553	38
23	9.8368784	9.8613997	9.9754787	10.0245213	10.1386003	10.1631216	37
24	9.8370121	9.8612803	9.9757318	10.0242682	10.1387197	10.1629879	36
25	9.8371456	9.8611608	9.9759849	10.0240151	10.1388392	10.1628544	35
26	9.8372791	9.8610412	9.9762379	10.0237621	10.1389588	10.1627209	34
27	9.8374125	9.8609215	9.9764909	10.0235091	10.1390785	10.1625875	33
28	9.8375458	9.8608018	9.9767440	10.0232560	10.1391982	10.1624542	32
29	9.8376790	9.8606821	9.9769970	10.0230030	10.1393179	10.1623210	31
30	9.8378122	9.8605622	9.9772500	10.0227500	10.1394378	10.1621878	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

46 DEGREES.

of the Chiefeſt Places of the World.

The Places Names.	North Latitud D.	North Latitud M	East Longit. D.	East Longit. M.	The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
River Decinda	24	55	95	39	Magadox	02	30	59	24
Gudar	24	50	89	28	Molinda	02 *S.*	42	52	11
Cape Muchoaridan	25	32	82	30	Tanga	05	20	52	01
Cape Ruſſalgat	22	07	84	39	Cape Faſlto	08	02	52	24
Cape de Ponto	8	19	79	09	Dagnada	15	17	53	26
Dofar	17	00	75	04	Cape Corintes	23	30	48	51
Cape de Matriaia	15	33	72	39	Cape *St.* Marin	25	40	46	59
Adon	13	08	66	50	River *St.* Luſſea	28	25	46	09
Cape Guardafuy	11	40	71	24	Bay Doliagoa	33	18	43	59
Cape de Baſlos	04	30	65	19					

43 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang	N. Secant.	N. Co-Secant.	
30	6883545	7253744	9489646	10537801	13785985	14527397	30
31	6885655	7251741	9495176	10531664	13789792	14522946	29
32	6887764	7249738	9500709	10525531	13793602	14518498	28
33	6889873	7247734	9506245	10519401	13797416	14514055	27
34	6891981	7245729	9511784	10513275	13801233	14509616	26
35	6894089	7243724	9517325	10507153	13805053	14505181	25
36	6896196	7241718	9522871	10501034	13808877	14500749	24
37	6898302	7239712	9528420	10494920	13812704	14496322	23
38	6900407	7237705	9533971	10488809	13816534	14491898	22
39	6902512	7235698	9539526	10482702	13820367	14487478	21
40	6904617	7233690	9545083	10476598	13824204	14483063	20
41	6906721	7231681	9550644	10470498	13828044	14478651	19
42	6918824	7229671	9556208	10464402	13831887	14474243	18
43	6910927	7227661	9561774	10458310	13835734	14469839	17
44	6913029	7225651	9567344	10452221	13839584	14465439	16
45	6915131	7223640	9572917	10446136	13843437	14461043	15
46	6917232	7221628	9578494	10440055	13847294	14456651	14
47	6919332	7219615	9584073	10433977	13851154	14452262	13
48	6921432	7217602	9589655	10427904	13855017	14447878	12
49	6923531	7215588	9595241	10421833	13858883	14443497	11
50	6925630	7213574	9600829	10415767	13862753	14439120	10
51	6927728	7211559	9606421	10409704	13866625	14434748	9
52	6929825	7209544	9612016	10403645	13870503	14430379	8
53	6931922	7207528	9617614	10397589	13874383	14426013	7
54	6934018	7205511	9623215	10391537	13878266	14421652	6
55	6936114	7203494	9628819	10385489	13882153	14417295	5
56	6938209	7201476	9634427	10379445	13886042	14412941	4
57	6940304	7199457	9640037	10373404	13889936	14408591	3
58	6942398	7197438	9645651	10367367	13893832	14404246	2
59	6944491	7195418	9651268	10361333	13897732	14399904	1
60	6946584	7193398	9656888	10355303	13901636	14395565	0
	N. Co-Sine.	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

46 DEGREES.

A Table of the Latitude and Longitude

The Sea-Coaſt from Cape Bone Eſprance *to* Guinney.

The Places Names.	*South Latitud.* D.	M.	*Eaſt Longit.* D.	M.
Iſland Defiſtian	36	57	11	44
Iſland Degiaiatica	37	5[illegible]	14	04

The Places Names.	*South Latitud.* D.	M.	*Eaſt Longit.* D.	M.
Cape Agullas	36	20	33	54
Cape Bone Eſprance	35	50	32	54
Cape Sacos	29	40	30	14
Aſcenſion Iſland	07	48	05	24
St. Hellena	16	03	10	08
St. Nova	16	03	19	48
Baſſas	17	45	27	35
Cape Lado	10	00	29	23
Cape Padron	06	00	29	04

43 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.8378122	9.8605622	9.9772500	10.0227500	10.1394378	10.1621878	30
31	9.8379453	9.8604423	9.9775030	10.0224970	10.1395577	10.1620547	29
32	9.8380783	9.8603223	9.9777560	10.0222440	10.1396777	10.1619217	28
33	9.8382112	9.8602022	9.9780090	10.0219910	10.1397978	10.1617888	27
34	9.8383441	9.8600821	9.9782620	10.0217380	10.1399179	10.1616559	26
35	9.8384769	9.8599619	9.9785149	10.0214851	10.1400381	10.1615231	25
36	9.8386096	9.8598416	9.9787679	10.0212321	10.1401584	10.1613904	24
37	9.8387422	9.8597213	9.9790209	10.0209791	10.1402787	10.1612578	23
38	9.8388747	9.8596009	9.9792738	10.0207262	10.1403991	10.1611253	22
39	9.8390072	9.8594804	9.9795268	10.0204732	10.1405196	10.1609928	21
40	9.8391396	9.8593599	9.9797797	10.0202203	10.1406401	10.1608604	20
41	9.8392719	9.8592393	9.9800326	10.0199674	10.1407607	10.1607281	19
42	9.8394041	9.8591186	9.9802856	10.0197144	10.1408814	10.1605959	18
43	9.8395363	9.8589978	9.9805385	10.0194615	10.1410022	10.1604637	17
44	9.8396684	9.8588770	9.9807914	10.0192086	10.1411230	10.1603316	16
45	9.8398004	9.8587561	9.9810443	10.0189557	10.1412439	10.1601996	15
46	9.8399323	9.8586351	9.9812972	10.0187028	10.1413649	10.1600677	14
47	9.8400642	9.8585141	9.9815501	10.0184499	10.1414859	10.1599358	13
48	9.8401959	9.8583929	9.9818030	10.0181970	10.1416071	10.1598041	12
49	9.8403276	9.8582718	9.9820559	10.0179441	10.1417282	10.1596724	11
50	9.8404593	9.8581505	9.9823087	10.0176913	10.1418495	10.1595407	10
51	9.8405908	9.8580292	9.9825616	10.0174384	10.1419708	10.1594092	9
52	9.8407223	9.8579078	9.9828145	10.0171855	10.1420922	10.1592777	8
53	9.8408537	9.8577863	9.9830673	10.0169327	10.1422137	10.1591463	7
54	9.8409850	9.8576648	9.9833202	10.0166798	10.1423352	10.1590150	6
55	9.8411162	9.8575432	9.9835730	10.0164270	10.1424568	10.1588838	5
56	9.8412474	9.8574215	9.9838259	10.0161741	10.1425785	10.1587526	4
57	9.8413785	9.8572998	9.9840787	10.0159213	10.1427002	10.1586215	3
58	9.8415095	9.8571779	9.9843315	10.0156685	10.1428221	10.1584905	2
59	9.8416404	9.8570561	9.9845844	10.0154156	10.1429439	10.1583596	1
60	9.8417713	9.8579341	9.9848372	10.0151628	10.1420650	10.1582287	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

46 DEGREES.

of the Chiefeſt Places of the World.

The Places Names.	*South Latitud* D.	M.	*Eaſt Longit.* D.	M.
Cape Lopas	01	00	25	21
Anabona Iſland	01	22	22	56
Iſland *St.* Mathaos	01	40	07	45
Iſland *St.* Toma	00*N.*	30	23	34
Iſland Chocos	00	40	23	50
River Gaboan	00	10	27	16
River de Angai	01	00	27	30
Iſland de Principas	01	50	25	14
Iſland Defarnanda	03	10	26	06

The Places Names.	*South. Latitud.* D.	M.	*Eaſt Longit.* D.	M.
River Boilin	02	42	27	29
River Decainaronas	04	00	27	09

The Sea-Coaſt from Samſon's *River to the River of* Gambo, *Coaſt* Guinney *and* Barbara.

Old Callabar	04*N.*	50	25*E.*	15

44 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
0	6946584	7193398	9656888	10355303	13901636	14395565	60
1	6948676	7191377	9662511	10349277	13905543	14391231	59
2	6950767	7189355	9668137	10343254	13909453	14386900	58
3	6952858	7187333	9673767	10337235	13913366	14382574	57
4	6954949	7185310	9679400	10331220	13917283	14378251	56
5	6957039	7183287	9685035	10325208	13921203	14373932	55
6	6959128	7181263	9690674	10319199	13925127	14369616	54
7	6961217	7179238	9696316	10313195	13929054	14365305	53
8	6963305	7177213	9701962	10307194	13932985	14360997	52
9	6965392	7175187	9707610	10301196	13936918	14356693	51
10	6967479	7173161	9713262	10295203	13940856	14352393	50
11	6969565	7171134	9718917	10289212	13944796	14348097	49
12	6971651	7169106	9724575	10283226	13948740	14343805	48
13	6973736	7167078	9730236	10277243	13952688	14339516	47
14	6975821	7165049	9735901	10271263	13956639	14335231	46
15	6977905	7163019	9741569	10265287	13960593	14330950	45
16	6979988	7160989	9747240	10259315	13964551	14326672	44
17	6982071	7158958	9752914	10253346	13968512	14322399	43
18	6984153	7156927	9758591	10247381	13972477	14318129	42
19	6986234	7154895	9764272	10241419	13976445	14313863	41
20	6988315	7152863	9769956	10235461	13980416	14309600	40
21	6990396	7150830	9775643	10229506	13984391	14305342	39
22	6992476	7148796	9781333	10223455	13988369	14301087	38
23	6994555	7146762	9787027	10217608	13992351	14296836	37
24	6996633	7144727	9792724	10211664	13996336	14292588	36
25	6998711	7142691	9798424	10205723	14000325	14288344	35
26	7000789	7140655	9804127	10199786	14004317	14284104	34
27	7002866	7138618	9809833	10193853	14008313	14279868	33
28	7004942	7136581	9815543	10187923	14012312	14275636	32
29	7007018	7134543	9821256	10181997	14016315	14271407	31
30	7009093	7132505	9826973	10176074	14020321	14267182	30
	N. Co-Sine	N. Sine.	N. Co-Tang.	N. Tangent.	N. Co-Secant.	N. Secant.	M

45 DEGREES.

A Table of the Latitude and Longitude

The Places Names.	North Latitud. D.	North Latitud. M.	East Longit. D.	East Longit. M.
New Callabar	04	40	23	37
Cape Formoffus	04	03	22	52
River Binnin	05	50	22	12
River Dallagoa	07	40	19	49
River de Valta	06	05	16	52
Cape 3 Points	04	10	13	10
River *St.* Andrafs	05	23	08	06
Cape de Palmas	04	40	06	05
River de Cafto	05	20	03	48
Cape Mounta	05	23	01	46
Cape Roxo	11	38	06W	13
River of Gambo	12	47	02	17
Cape de Verd	14	24	06	57

44 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
0	9.8517713	9.8569341	9.9848372	10.0151628	10.1430659	10.1582287	60
1	9.8419021	9.8568121	9.9850900	10.0149100	10.1431879	10.1580979	59
2	9.8420328	9.8566900	9.9853428	10.0146572	10.1433100	10.1579672	58
3	9.8421634	9.8565678	9.9855956	10.0144044	10.1434322	10.1578366	57
4	9.8422939	9.8564455	9.9858484	10.0141516	10.1435545	10.1577061	56
5	9.8424244	9.8563232	9.9861012	10.0138988	10.1436768	10.1575756	55
6	9.8425548	9.8562008	9.9863540	10.0136460	10.1437992	10.1574452	54
7	9.8426851	9.8560784	9.9866068	10.0133932	10.1439216	10.1573149	53
8	9.8428154	9.8559558	9.9868596	10.0131404	10.1440442	10.1571846	52
9	9.8429456	9.8558332	9.9871123	10.0128877	10.1441668	10.1570544	51
10	9.8430757	9.8557106	9.9873651	10.0126349	10.1442894	10.1569243	50
11	9.8432057	9.8555878	9.9876179	10.0123821	10.1444122	10.1567943	49
12	9.8433356	9.8554650	9.9878706	10.0121294	10.1445350	10.1566644	48
13	9.8434655	9.8553421	9.9881234	10.0118766	10.1446579	10.1565345	47
14	9.8435953	9.8552192	9.9883761	10.0116239	10.1447808	10.1564047	46
15	9.8437250	9.8550961	9.9886289	10.0113711	10.1449039	10.1562750	45
16	9.8438547	9.8549730	9.9888816	10.0111184	10.1450270	10.1561453	44
17	9.8439842	9.8548499	9.9891344	10.0108656	10.1451501	10.1560158	43
18	9.8441137	9.8547266	9.9893871	10.0106129	10.1452734	10.1558863	42
19	9.8442432	9.8546033	9.9896399	10.0103601	10.1453967	10.1557568	41
20	9.8443725	9.8544799	9.9898926	10.0101014	10.1455201	10.1556275	40
21	9.8445018	9.8543564	9.9901453	10.0098547	10.1456436	10.1554982	39
22	9.8446310	9.8542329	9.9903981	10.0096019	10.1457671	10.1553690	38
23	9.8447601	9.8541093	9.9906508	10.0093492	10.1458907	10.1552399	37
24	9.8448891	9.8539856	9.9909035	10.0090965	10.1460144	10.1551109	36
25	9.8450181	9.8538619	9.9911562	10.0088438	10.1461381	10.1549819	35
26	9.8451470	9.8537381	9.9914089	10.0085911	10.1462619	10.1548530	34
27	9.8452758	9.8536142	9.9916616	10.0083384	10.1463858	10.1547242	33
28	9.8454045	9.8534902	9.9919143	10.0080857	10.1465098	10.1545955	32
29	9.8455332	9.8533662	9.9921670	10.0078330	10.1466338	10.1544668	31
30	9.8456618	9.8532421	9.9924197	10.0075803	10.1467579	10.1543382	30
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

45 DEGREES.

44 DEGREES.

M	N. Sine.	N. Co-Sine.	N. Tangent.	N. Co-Tang.	N. Secant.	N. Co-Secant.	
30	7009093	7132505	9826973	10176074	14020321	14267182	30
31	7011167	7130466	9832692	10170155	14024330	14262961	29
32	7013241	7128426	9838415	10164239	14028343	14258743	28
33	7015314	7126385	9844141	10158326	14032360	14254529	27
34	7017387	7124344	9849871	10152417	14036380	14250319	26
35	7019459	7122302	9855603	10146512	14040403	14246112	25
36	7021530	7120260	9861339	10140610	14044430	14241909	24
37	7023601	7118217	9867079	10134712	14048460	14237710	23
38	7025671	7116174	9872821	10128817	14052494	14233514	22
39	7027741	7114130	9878567	10122925	14056532	14229323	21
40	7029810	7112086	9884316	10117037	14060573	14225134	20
41	7031879	7110041	9890069	10111153	14064617	14220950	19
42	7033947	7107995	9895825	10105272	14068665	14216769	18
43	7036014	7105948	9901584	10099394	14072717	14212592	17
44	7038081	7103901	9907346	10093520	14076772	14208418	16
45	7040147	7101854	9913112	10087649	14080831	14204248	15
46	7042213	7099806	9918881	10081782	14084893	14200082	14
47	7044278	7097757	9924654	10075918	14088958	14195919	13
48	7046342	7095707	9930429	10070058	14093028	14191761	12
49	7048406	7093657	9936208	10064201	14097100	14187605	11
50	7050469	7091607	9941991	10058347	14101177	14183454	10
51	7052532	7089556	9947777	10052497	14105256	14179305	9
52	7054594	7087504	9953566	10046651	14109340	14175161	8
53	7056655	7085451	9959358	10040807	14113427	14171020	7
54	7058716	7083398	9965154	10034968	14117517	14166883	6
55	7060776	7081345	9970953	10029131	14121611	14162749	5
56	7062835	7079291	9976756	10023298	14125709	14158619	4
57	7064894	7077236	9982562	10017469	14129810	14154493	3
58	7066953	7075180	9988371	10011642	14133915	14150370	2
59	7069011	7073124	9994184	10005819	14138024	14146251	1
60	7071068	7071068	10000000	10000000	14142136	14142136	0
	N. Co-Sine.	N. Sine.	N.Co-Tang.	N. Tangent.	N.Co-Secant.	N. Secant.	M

45 DEGREES.

44 DEGREES.

M	L. Sine.	L. Co-Sine.	L. Tangent.	L. Co-Tang.	L. Secant.	L. Co-Secant.	
30	9.8456618	9.8532421	9.9924197	10.0075803	10.1467579	10.1543382	30
31	9.8457903	9.8531179	9.9926724	10.0073276	10.1468821	10.1542097	29
32	9.8459188	9.8529936	9.9929251	10.0070749	10.1470064	10.1540812	28
33	9.8460471	9.8528693	9.9931778	10.0068222	10.1471307	10.1539519	27
34	9.8461754	9.8527449	9.9934305	10.0065695	10.1472551	10.1538246	26
35	9.8463036	9.8526204	9.9936832	10.0063168	10.1473796	10.1536964	25
36	9.8464318	9.8524959	9.9939359	10.0060641	10.1475041	10.1535682	24
37	9.8465599	9.8523713	9.9941886	10.0058114	10.1476287	10.1534401	23
38	9.8466879	9.8522466	9.9944413	10.0055587	10.1477534	10.1533121	22
39	9.8468158	9.8521218	9.9946940	10.0053060	10.1478782	10.1531842	21
40	9.8469436	9.8519970	9.9949466	10.0050534	10.1480030	10.1530564	20
41	9.8470714	9.8518721	9.9951993	10.0048007	10.1481279	10.1529286	19
42	9.8471991	9.8517471	9.9254520	10.0045480	10.1482529	10.1528009	18
43	9.8473267	9.8516220	9.9957047	10.0042953	10.1483780	10.1526733	17
44	9.8474543	9.8514969	9.9959573	10.0040427	10.1485031	10.1525457	16
45	9.8475817	9.8513717	9.9962100	10.0037900	10.1486283	10.1524183	15
46	9.8477091	9.8512465	9.9964627	10.0035373	10.1487535	10.1522909	14
47	9.8478365	9.8511211	9.9967154	10.0032846	10.1488789	10.1521635	13
48	9.8479637	9.8509957	9.9969680	10.0030320	10.1490043	10.1520363	12
49	9.8480909	9.8508702	9.9972207	10.0027793	10.1491298	10.1519091	11
50	9.8482180	9.8507446	9.9974734	10.0025266	10.1492554	10.1517820	10
51	9.8483450	9.8506190	9.9977260	10.0022740	10.1493810	10.1516550	9
52	9.8484720	9.8504933	9.9979787	10.0020213	10.1495067	10.1515280	8
53	9.8485989	9.8503675	9.9982314	10.0017686	10.1496325	10.1514011	7
54	9.8487257	9.8502417	9.9984840	10.0015160	10.1497583	10.1512743	6
55	9.8488524	9.8501157	9.9987367	10.0012633	10.1498843	10.1511476	5
56	9.8489791	9.8499897	9.9989893	10.0010107	10.1500103	10.1510209	4
57	9.8491057	9.8498637	9.9992420	10.0007580	10.1501363	10.1508943	3
58	9.8492322	9.8497375	9.9994947	10.0005053	10.1502625	10.1507678	2
59	9.8493586	9.8496113	9.9997473	10.0002527	10.1503887	10.1506414	1
60	9.8494850	9.8494850	10.0000000	10.0000000	10.1505150	10.1505150	0
	L. Co-Sine.	L. Sine.	L. Co-Tang.	L. Tangent.	L. Co-Secant.	L. Secant.	M

45 DEGREES.

The END *of the* TABLE *of* Sines, Tangents, *and* Secants.

Suns Declination.

Anno 1681, 1685, 1689.

Days.	*Jan.* South.		*Feb.* South.		*Mar.* South.		*April.* North.		*May.* North.		*June.* North.		*July.* North.		*Aug.* North.		*Sept.* North.		*Octob.* South.		*Nov.* South.		*Dec.* South.	
	D.	*M.*	*D.*	*M.*	*M.*	*D.*	*D.*	*M.*	*M.*	*D.*	*D.*	*M.*	*D.*	*M.*	*D.*	*M.*	*D.*	*M.*	*D.*	*M.*	*D.*	*M.*	*D.*	*M.*
1	21	41	13	42	3	20	8	40	18	7	23	11	22	4	15	6	4	17	7	21	17	43	23	8
2	21	31	13	22	2	56	9	2	18	22	23	15	21	56	14	48	3	54	7	54	17	59	23	13
3	21	21	13	2	2	32	9	23	18	37	23	18	21	47	14	30	3	31	8	6	18	15	23	16
4	21	10	12	41	2	9	9	45	18	51	23	21	21	38	14	11	3	8	8	29	18	31	23	20
5	20	58	12	21	1	45	10	6	19	6	23	24	21	28	13	52	2	45	8	51	18	46	23	23
6	20	47	11	59	1	21	10	27	19	19	23	26	21	18	13	33	2	21	9	13	19	1	23	25
7	20	34	11	38	0	59	10	48	19	33	23	27	21	8	13	14	1	58	9	35	19	16	23	27
8	20	22	11	17	0	34	11	9	19	46	23	29	20	58	12	54	1	35	9	56	19	30	23	28
9	20	9	10	56	0	10	11	30	19	59	23	30	20	47	12	35	1	11	10	19	19	44	23	29
10	19	56	10	34	*Nor.*	13	11	50	20	11	23	30	20	35	12	15	0	48	10	40	19	57	23	30
11	19	42	10	12	0	37	12	11	20	23	23	30	20	24	11	55	0	24	11	2	20	10	23	30
12	19	28	9	50	1	01	12	31	20	35	23	30	20	12	11	35	0	01	11	23	20	23	23	30
13	19	14	9	28	1	24	12	50	20	46	23	29	19	59	11	14	*Sou.*	22	11	44	20	36	23	29
14	18	59	9	6	1	48	13	10	20	57	23	27	19	47	10	53	0	46	12	5	20	48	23	27
15	18	44	8	43	2	11	13	30	21	8	23	26	19	34	10	33	1	9	12	26	20	59	23	25
16	18	29	8	21	2	35	13	49	21	18	23	24	19	20	10	12	1	33	12	46	21	11	23	23
17	18	13	7	58	2	38	14	8	21	28	23	21	19	7	9	51	1	56	13	7	21	21	23	20
18	17	57	7	36	3	22	14	27	21	38	23	28	18	53	9	29	2	20	13	27	21	32	23	17
19	17	41	7	13	3	45	14	45	21	47	23	15	18	38	9	7	2	44	13	47	21	42	23	13
20	17	24	6	50	4	8	15	3	21	56	23	11	18	24	8	46	3	[illegible]	14	7	21	51	23	9
21	17	7	6	27	4	31	15	21	22	4	23	7	18	9	8	24	3	30	14	26	22	1	23	4
22	16	50	6	4	4	54	15	39	22	12	23	3	17	54	8	2	3	54	14	45	22	9	22	59
23	16	32	5	40	5	17	15	57	22	20	22	58	17	38	7	40	4	17	15	4	22	18	22	54
24	16	14	5	17	5	40	16	14	22	27	22	53	17	22	7	18	4	40	15	23	22	26	22	48
25	15	56	4	54	6	13	16	31	22	34	22	47	17	6	6	56	5	3	15	41	22	33	22	41
26	15	38	4	30	6	26	16	48	22	41	22	41	16	50	6	34	5	27	16	0	22	40	22	34
27	15	20	4	7	6	49	17	4	22	47	22	34	16	33	6	11	5	50	16	18	22	47	22	27
28	15	0	3	43	7	11	17	21	22	53	22	27	16	16	5	48	6	12	16	35	22	53	22	19
29	14	41			7	33	17	37	22	58	22	20	15	59	5	26	6	36	16	53	22	58	22	11
30	14	22			7	56	17	52	23	3	22	12	15	42	5	3	6	58	17	10	23	[illegible]	22	2
31	14	2			8	18			23	7			15	24	4	40			17	27			21	53

Suns Declination.

Anno 1682, 1686, 1690.

Days	Jan.		Feb.		Mar.		April.		May.		June.		July.		Aug.		Sept.		Octob.		Nov.		Dec.	
	South.		South.		South.		North.		North		North.		North.		North.		North.		South.		South.		South.	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M
1	21	43	13	47	3	26	8	34	18	4	23	11	22	6	15	11	4	23	7	15	17	39	23	7
2	21	34	13	27	3	02	8	56	18	19	23	14	21	58	14	53	4	0	7	38	17	55	23	12
3	21	23	13	7	2	38	9	18	18	34	23	18	21	49	14	34	3	37	8	1	18	12	23	15
4	21	12	12	46	2	15	9	40	18	48	23	21	21	40	14	16	3	14	8	23	18	27	23	19
5	21	1	12	25	1	51	10	01	19	2	23	23	21	31	13	57	2	50	8	46	18	42	23	22
6	20	49	12	5	1	27	10	22	19	16	23	25	21	21	13	38	2	27	9	8	18	58	23	24
7	20	37	11	43	1	03	10	43	19	29	23	27	21	11	13	19	2	04	9	30	19	12	23	27
8	20	25	11	22	0	40	11	4	19	43	23	28	21	0	12	59	1	40	9	52	19	26	23	28
9	20	12	11	01	0	16	11	25	19	55	23	29	20	49	12	39	1	17	10	13	19	40	23	29
10	19	59	10	39	Nor.	4	11	45	20	8	23	30	20	3[illegible]	12	20	0	53	10	35	19	54	23	30
11	16	49	10	17	0	31	12	6	20	20	23	30	20	27	12	0	0	30	10	57	20	7	23	30
12	19	32	9	55	0	55	12	26	20	32	23	30	20	14	11	40	0	7	11	18	20	20	23	30
13	19	18	9	33	1	19	12	46	20	44	23	29	20	2	11	19	Sou.	17	11	39	20	33	23	29
14	19	3	9	11	1	42	13	5	20	55	23	28	19	50	10	58	0	40	12	0	20	45	23	28
15	18	48	8	49	2	05	13	25	21	5	23	26	19	37	10	38	1	04	12	21	20	57	23	26
16	18	33	8	26	2	29	13	44	21	16	23	24	19	23	10	17	1	27	12	41	21	8	23	24
17	18	17	8	4	2	53	14	3	21	26	23	22	19	10	9	56	1	51	13	2	21	19	23	21
18	18	1	7	41	3	16	14	22	21	36	23	19	18	56	9	34	2	14	13	22	21	29	23	18
19	17	45	7	18	3	39	14	41	21	45	23	16	18	42	9	13	2	38	13	42	21	39	23	14
20	17	28	6	55	4	03	14	59	21	54	23	12	18	27	8	51	3	01	14	2	21	49	23	10
21	17	11	6	32	4	26	15	17	22	2	23	8	18	12	8	29	3	25	14	21	21	58	23	6
22	16	54	6	9	4	49	15	25	22	10	23	4	17	57	8	8	3	48	14	41	22	7	23	1
23	16	37	5	46	5	12	15	35	22	18	22	59	17	42	7	46	4	11	15	0	22	16	22	55
24	16	19	5	23	5	35	16	10	22	26	22	54	17	26	7	24	4	34	15	18	22	24	22	49
25	16	1	4	59	5	58	16	27	22	33	22	48	17	10	7	01	4	58	15	37	22	31	22	43
26	15	42	4	36	6	21	16	44	22	39	22	42	16	54	6	39	5	21	15	55	22	38	22	36
27	15	24	4	12	6	[illegible]	17	0	22	45	22	36	16	37	6	17	5	44	16	13	22	45	22	29
28	15	5	3	49	7	8	17	17	22	51	22	29	16	21	5	[illegible]	6	7	16	31	22	51	22	21
29	14	46			7	2[illegible]	17	33	22	57	22	22	16	3	5	31	6	30	17	39	22	57	22	13
30	14	27			7	5[illegible]	17	48	23	2	22	14	15	46	5	8	6	53	17	6	23	2	22	4
31	14	[illegible]			8	1[illegible]			23	6			15	28	4	46			17	23			21	55

Suns Declination.

Anno 1683, 1687, 1691.

Days.	Jan.		Feb.		Mar.		April.		May.		June.		July.		Aug.		Sept.		Octob.		Nov.		Dec.	
	South.		South.		South.		North.		North.		North.		North.		North.		North.		South.		South.		South.	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	21	46	13	52	3	31	8	29	18	0	23	10	22	8	15	15	4	28	7	10	17	35	23	6
2	21	36	13	32	3	8	8	51	18	15	23	13	22	0	14	57	4	5	7	33	17	52	23	11
3	21	26	13	12	2	44	9	13	18	30	23	17	21	51	14	39	3	42	7	55	18	8	23	15
4	21	15	12	51	2	20	9	34	18	44	23	20	21	43	14	20	3	19	8	18	18	23	23	18
5	21	04	12	31	1	57	9	56	18	59	23	23	21	33	14	01	2	56	8	40	18	39	23	21
6	20	52	12	10	1	33	10	17	19	13	23	25	21	23	13	43	2	33	9	2	18	54	23	24
7	20	40	11	49	1	9	10	38	19	26	23	27	21	13	13	23	2	9	9	24	19	9	23	26
8	20	28	11	28	0	45	10	59	19	40	23	28	21	3	13	4	1	46	9	47	19	23	23	28
9	20	15	11	6	0	22	11	20	19	52	23	29	20	52	12	44	1	23	10	8	19	37	23	29
10	20	2	10	44	No.	02	11	40	20	5	23	30	20	41	12	24	0	59	10	30	19	51	23	30
11	19	49	10	23	0	26	12	1	20	17	23	30	20	29	12	5	0	36	10	51	20	4	23	30
12	19	35	10	1	0	49	12	21	20	29	23	30	20	18	11	44	0	12	11	13	20	17	23	30
13	19	21	9	39	1	13	12	41	20	41	23	29	20	5	11	24	Sou.	11	11	34	20	30	23	29
14	19	7	9	17	1	36	13	0	20	52	23	28	19	53	11	3	0	35	11	55	20	42	23	28
15	18	52	8	54	2	00	13	20	21	03	23	27	19	40	10	43	0	58	12	16	20	54	23	26
16	18	36	8	32	2	23	13	40	21	13	23	25	19	27	10	22	1	22	12	36	21	5	23	24
17	18	21	8	9	2	47	13	59	21	24	23	22	19	13	10	45	1	45	12	57	21	16	23	22
18	18	5	7	46	3	10	14	18	21	33	23	20	19	0	9	40	2	9	13	17	21	27	23	19
19	17	49	7	24	3	34	14	36	21	43	23	17	18	45	9	18	2	32	13	37	21	37	23	15
20	17	32	7	01	3	57	14	55	21	52	23	13	18	31	8	56	2	55	13	57	21	47	23	11
21	17	15	6	38	4	20	15	13	22	0	23	9	18	16	8	35	3	19	14	17	21	56	23	7
22	16	58	6	15	4	43	15	31	22	8	23	5	18	1	8	13	3	42	14	36	22	5	22	2
23	16	41	5	52	5	06	15	48	22	16	23	0	17	46	7	51	4	6	14	55	22	14	22	57
24	16	23	5	28	5	29	16	6	22	24	22	55	17	30	7	29	4	29	15	14	22	22	22	51
25	16	5	5	5	5	52	16	23	22	31	22	50	17	14	7	7	4	52	15	32	22	29	22	44
26	15	47	4	42	6	15	16	40	22	38	22	44	16	58	6	44	5	15	15	51	22	37	22	38
27	15	28	4	18	6	37	16	56	22	44	22	37	16	42	6	22	5	38	16	9	22	43	22	31
28	15	10	3	55	7	0	17	12	22	50	22	31	16	25	5	59	6	2	16	2[illegible]	22	50	22	23
29	14	50			7	23	17	29	22	55	22	24	16	8	5	37	6	24	16	44	22	56	22	15
30	14	31			7	45	17	44	23	0	22	16	15	50	5	14	6	47	17	2	23	1	22	6
31	14	12			8	07			23	[illegible]			15	33	4	51			17	1[illegible]			21	58

Suns Declination.

Anno 1684, 1688, 1692.

Days.	Jan.		Feb.		Mar.		April.		May.		June.		July.		Aug.		Sept.		Octob.		Nov.		Dec.	
	South.		South.		South.		North.		North		North.		North.		North.		North.		South.		South.		South.	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M
1	21	48	13	57	3	13	8	46	18	0	23	12	22	2	15	1	4	11	7	27	17	48	23	9
2	21	38	13	37	2	50	9	7	18	27	23	16	21	54	14	43	3	48	7	50	18	4	23	14
3	21	28	13	17	2	26	9	29	18	41	23	19	21	45	14	21	3	25	8	12	18	20	23	17
4	21	1[illegible]	12	56	2	2	9	51	18	55	23	22	21	35	14	6	3	2	8	35	18	35	23	21
5	21	7	12	36	1	39	10	12	19	9	23	24	21	26	13	47	2	38	8	57	18	50	23	23
6	20	55	12	15	1	15	10	33	19	23	23	26	21	16	13	28	2	15	9	18	19	5	23	26
7	20	43	11	54	0	51	10	54	19	36	23	28	21	05	13	9	1	52	9	41	19	20	23	27
8	20	31	11	32	0	28	11	15	19	49	23	29	20	55	12	49	1	28	10	3	19	34	23	29
9	20	19	11	11	0	4	11	35	20	2	23	30	20	44	12	29	1	5	10	25	19	47	23	30
10	20	5	10	50	No.	20	11	56	20	14	23	30	20	32	12	10	0	41	10	46	20	01	23	30
11	19	52	10	28	0	43	12	16	20	27	23	30	20	21	11	49	0	18	11	8	20	14	23	30
12	19	38	10	6	1	7	12	36	20	38	23	29	20	08	11	29	Sou.	6	11	29	20	27	23	29
13	19	24	9	44	1	30	12	56	20	49	23	28	19	56	11	8	0	29	11	50	20	39	23	28
14	19	10	9	22	1	54	13	15	21	0	23	27	19	43	10	48	0	53	12	11	20	51	23	27
15	18	55	9	00	2	18	13	35	21	11	23	25	19	30	10	27	1	16	12	32	21	2	23	25
16	18	40	8	37	2	41	13	54	21	21	23	23	19	17	10	6	1	40	12	52	21	13	23	22
17	18	24	8	15	3	05	14	13	21	31	23	10	19	03	9	45	2	3	13	12	21	24	23	19
18	18	9	7	52	3	28	14	32	21	40	23	17	18	49	9	23	2	27	13	32	21	35	23	16
19	17	53	7	29	3	51	14	50	21	49	23	14	18	34	9	2	2	50	13	52	21	44	23	12
20	17	36	7	7	4	14	15	8	21	58	23	10	18	20	8	40	3	13	14	12	21	54	23	8
21	17	20	6	44	4	38	15	26	22	7	23	6	18	05	8	18	3	37	14	31	22	3	23	3
22	17	2	6	21	5	01	15	44	22	14	23	1	17	50	7	56	4	0	14	50	22	12	22	58
23	16	45	5	57	5	24	16	2	22	22	22	56	17	34	7	34	4	23	15	9	22	20	22	52
24	16	27	5	34	5	47	16	19	22	29	22	51	17	18	7	12	4	47	15	28	22	28	22	46
25	16	10	5	11	6	9	16	36	22	36	22	45	17	02	6	50	5	10	15	47	22	35	22	39
26	15	51	4	47	6	32	16	52	22	43	22	39	16	46	6	27	5	33	16	5	22	42	22	32
27	15	33	4	24	6	55	17	9	22	49	22	32	16	29	6	5	5	56	16	23	22	48	22	25
28	15	14	4	1	7	17	17	25	22	54	22	25	16	12	5	42	6	19	16	40	22	54	22	17
29	14	55	3	37	7	39	17	41	22	59	22	18	15	55	5	20	6	42	16	58	23	0	22	9
30	14	36			8	02	17	56	23	04	22	10	15	37	4	57	7	05	17	15	23	5	22	0
31	14	16			8	24			23	9			15	20	4	34			17	31			21	51

A Table, whereby you may proportion the Suns Declination to any other Meridian.

The dayly Diff. in Declination.		′ 03	′ 06	′ 09	′ 12	′ 15	′ 18	′ 21	′ 24
Deg.	15	0	0	0	0	0	1	1	1
	30	0	0	0	1	1	1	2	2
	45	0	0	1	1	2	2	3	3
	60	0	1	1	2	2	3	3	4
Degrees of Longitude either East, or West.	75	0	1	2	2	3	4	4	5
	90	0	1	2	3	4	4	5	6
	105	1	2	2	3	4	5	6	7
	120	1	2	3	4	5	6	7	8
	135	1	2	3	4	5	7	8	9
	150	1	2	3	5	6	8	9	10
	165	1	2	4	5	6	8	10	11
	180	1	3	4	6	7	9	11	12

The Refraction of the Stars.

Alt.	Refract.	
°	′	″
0	30	00
1	25	12
2	18	24
3	14	00
4	11	0
5	09	30
6	7	30
7	6	30
8	5	45
9	5	0
10	4	30
11	4	0
12	4	00
13	3	30
14	3	00
15	3	0
16	3	00
17	2	30
18	2	30
19	2	00
20	2	00
21	2	0
22	2	0
23	2	0
24	1	30
25	1	30
26	1	30
27	1	30
28	1	30
29	1	00
30	1	00

A Table of the Suns RIGHT ASCENSION.

Days.	*Jan.* Ascen.		*Feb.* Ascen.		*Mar.* Ascen.		*April.* Ascen.		*May.* Ascen.		*June.* Ascen.		*July.* Ascen.		*Aug.* Ascen.		*Sept.* Ascen.		*Octob.* Ascen.		*Nov.* Ascen.		*Dec.* Ascen.	
	H.	*M.*	*H.*	*M.*	*H.*	*M.*	*H.*	*M.*	*H.*	*M.*	*H.*	*M.*	*H.*	*M.*	*H.*	*M.*	*H.*	*M.*	*H.*	*M.*	*H.*	*M*	*H.*	*M.*
1	19	35	21	43	23	28	1	21	3	14	5	20	7	24	9	26	11	19	13	08	15	08	17	16
2	19	38	21	46	23	32	1	25	3	18	5	24	7	28	9	29	11	23	13	12	15	12	17	21
3	19	43	21	50	23	36	1	29	3	22	5	28	7	33	9	33	11	26	13	16	15	16	17	25
4	19	47	21	54	23	39	1	32	3	26	5	32	7	36	9	37	11	30	13	19	15	21	17	30
5	19	51	21	59	23	43	1	36	3	30	5	36	7	40	9	41	11	34	13	23	15	25	17	34
6	19	56	22	02	23	47	1	40	3	34	5	40	7	44	9	44	11	38	13	27	15	29	17	38
7	20	00	22	06	23	50	1	43	3	38	5	44	7	48	9	48	11	41	13	31	15	33	17	43
8	20	05	22	11	23	54	1	47	3	42	5	49	7	52	9	52	11	45	13	34	15	37	17	47
9	20	09	22	14	23	58	1	51	3	46	5	53	7	56	9	56	11	48	13	38	15	4[illegible]	17	52
10	20	13	22	17	0	01	1	54	3	50	5	57	8	00	9	59	11	52	13	42	15	45	17	56
11	20	17	22	21	00	05	1	58	3	54	6	1	8	04	10	03	11	55	13	46	15	50	18	01
12	20	21	22	25	0	08	2	02	3	58	6	5	8	08	10	07	11	59	13	49	15	54	18	05
13	20	25	22	29	0	12	2	06	4	02	6	9	8	12	10	10	12	3	13	53	15	58	18	10
14	20	30	22	33	0	16	2	09	4	06	6	14	8	16	10	14	12	6	13	57	16	02	18	14
15	20	34	22	36	0	19	2	13	4	10	6	18	8	20	10	18	12	10	14	01	16	06	18	18
16	20	38	22	40	0	23	2	17	4	14	6	22	8	24	10	22	12	14	14	05	16	11	18	22
17	20	42	22	44	0	27	2	21	4	18	6	26	8	28	10	25	12	17	14	09	16	15	18	27
18	20	46	22	48	0	30	2	24	4	22	6	30	8	32	10	29	12	21	14	13	16	19	18	32
19	20	50	22	51	0	34	2	28	4	26	6	34	8	36	10	32	12	24	14	16	16	24	18	36
20	20	54	22	55	0	38	2	32	4	30	6	38	8	40	10	36	12	28	14	20	16	28	18	41
21	20	59	22	59	0	41	2	36	4	34	6	42	8	43	10	40	12	31	14	24	16	32	18	45
22	21	03	23	03	0	45	2	40	4	38	6	47	8	47	10	43	12	35	14	28	16	37	18	49
23	21	07	23	06	0	48	2	44	4	43	6	51	8	51	10	47	12	39	14	32	16	41	18	54
24	21	11	23	10	0	52	2	47	4	47	6	55	8	55	10	51	12	43	14	36	16	45	18	58
25	21	15	23	14	0	56	2	51	4	51	6	59	8	59	10	54	12	46	14	40	16	50	19	03
26	21	19	23	17	0	59	2	55	4	55	7	03	9	03	10	58	12	50	14	44	16	54	19	07
27	21	23	23	21	1	03	2	59	4	59	7	07	9	06	11	02	12	54	14	48	16	59	19	1
28	21	27	23	25	1	06	3	03	5	03	7	11	9	10	11	05	12	57	14	52	17	03	19	16
29	21	31			1	10	3	07	5	07	7	15	9	14	11	09	13	01	14	56	17	07	19	20
30	21	35			1	14	3	10	5	11	7	20	9	18	11	12	13	4	15	00	17	12	19	24
31	21	39			1	17			5	15			9	22	11	16			15	04			19	29

A Table of the Right Ascensions, and Declinations of the fixed Stars, For the Year 1700. with their Differences in 100.

Mag.	*The Names of the Stars.*	*Right Ascen.* H.	M.	*Declinations.* D.	M.	*Diff Rig.* M	*Dif. Dec* M
3	In *Cassiopeia's* breast	0	24	54	55	6	34
2	The Pole Star	0	39	87	43½	16	34
2	The Southermost in the Whales Tail	0	29	19	38S	5	34
2	*Andromeda's* girdle	0	53	34	05	5	33
3	*Cassiopeia's* knee	1	07	58	40	6	33
3	The Whales belly	1	37	11	45S	5	31
2	The South foot of *Andromeda*	1	46	40	53	6	30
3	The bright Star of ♈	1	51	22	03	6	30
2	In the Whales chap	2	47	02	54	5	25
3	*Medusa's* head	2	49	39	47	6	25
2	*Perseus* bright side	3	02	48	43	6	21
3	The brightest of the *Pleiades*	3	30	23	10	6	21
3	The North eye of ♉	4	11	18	31	6	17
1	*Aldebaran*, or the South eye of ♉	4	19	15	53	6	15
1	The Goat *Capella*	4	55	45	40	7	10
1	The bright foot of *Orion*, *Regel*	5	01	8	33½S	5	9½
1	The North-horn of ♉	5	08	28	20	6	8
2	*Orion's* left shoulder	5	09	6	03	5	8
2	1 In *Orions* girdle	5	17	0	32S	5	7
3	The Bulls South horn	5	20	20	58	6	7
2	2 In *Orions* girdle	5	21	01	24S	5	6
2	3 In *Orions* girdle	5	26	02	07S	5	5
2	The right shoulder *Auriga*	5	38	44	54	8	4
2	The bright foot of ♊	6	20	16	38	6	2
1	The great Dog *Sirius*	6	32	16	15S	5	4
2	The upper head of ♊	7	16	32	30	7	11
2	The lesser Dog, *Procyon*	7	24	6	0	5	12
2	The lower head of ♊	7	31	28	43	6	12
1	*Hydra's* heart	9	13	7	22S	5	25
1	The Lions heart, *Basiliscus*	9	53	13	25	5	28½
2	The middlemost in the Lions neck	10	00	21	21	6	29
1	The Lions Tail	11	24	16	15	5	34
2	The Root of the Great Bears Tail	12	41	57	37	5	33
1	Virgins spike	13	10	09	33½S	5	32½
2	The last but one in the Great Bears Tail	13	12	56	31	4	32

Mag.	The Names of the Stars.	Right Ascen. H. M.	Declinations. D. M.	Diff Rig.	Dif. Dec.
2	The last in the Great Bears Tail--	13 36	50 51	4	31
1	*Arcturus*-—	14 02	20 49	5	29½
2	The South Ballance—	14 34	14 45S	5	27
2	The North Ballance —	15 01	8 14S	5	24
2	Bright Star of the Crown--	15 22	27 45	4	21
2	The bright * in the Serpents Neck--	15 30	7 25	5	21
3	The left hand of *Ophiuchus*	15 59	2 55S	5	18
1	*Scorpions* hart *Antares*.—	16 11	25 42S	6	16
3	*Hercules* right shoulder—	16 17	22 12	4	15
3	The left knee of *Ophiuchus*	16 21	9 54S	5	15
3	The right knee of *Ophiuchus*-—	16 51	15 17S	3	10
3	*Hercules* his head———	17 01	14 47	4	8
3	*Hercules* left shoulder—	17 02	25 14	4	8
3	The head of *Ophiuchus*—	17 21	12 49	5	7
3	The right shoulder of *Ophiuchus*—	17 29	4 44	5	5
3	The bright star in the Dragons head—	17 50	51 35	2	2
1	*Lyra*— —	18 27	38 32	3	4
3	The Vulturs Tail-——	18 52	23 28	5	8
3	The Swans beak——	19 19	27 21	4	11
2	The bright Star of the Vulture —	19 36	8 07	5	13
3	The upper horn of ♑—	20 01	13 24S	6	16
3	The lower horn of ♑—	20 04	15 40S	6	17
3	The Swans breast-—	20 12	39 19	4	18
4	The left hand of *Aquarius*.	20 31	10 34S	5	19
2	The Swans tail	20 31	44 14	3	20½
3	The Swans lower wing.	20 34	32 51	4	21
3	The left shoulder of *Aquarius*-—	21 16	6 49S	4	26
3	The Girdle of *Cæpheus* -	21 25	69 16	1	26
3	*Pegasus* mouth	21 30	8 31	5	26
3	The right shoulder of *Aquary*.—	21 51	1 44S	5	29
1	*Fomahant* -—	22 41	31 08S	6	31
2	*Scheat*——	22 49	26 28	5	32
2	*Marchab* —	22 50	13 37	5	32
2	*Andromeda's* head ——	23 53	27 28	5	34

If the Right Ascention be less than 6 hours or more than 18 hours, the Declinations of those Stars that are to the North of the Equinoctial must be increased by the Difference for time to come; and the Southern Stars Declinations decreased: but in the other Hemisphere where the Right Ascension is more than 6 hours, or less than 18 hours, the contrary.

A TABLE OF VERSED SINES

BOTH

NATURAL and ARTIFICIAL.

00 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	0	10000000	0.0000000	10.00000000	60
1	1	9997091	2.6264222	9.9998736	59
2	2	9994182	3.2284822	9.9997473	58
3	4	9991273	3.5806647	9.9996208	57
4	7	9988364	3.8305422	9.9994944	56
5	11	9985456	4.0243620	9.9993679	55
6	16	9982547	4.1827246	9.9992414	54
7	22	9979638	4.3166182	9.9991148	53
8	28	9976729	4.4326020	9.9989882	52
9	35	9973820	4.5349070	9.9988615	51
10	43	9970912	4.6264219	9.9987348	50
11	52	9968003	4.7092072	9.9986081	49
12	62	9965094	4.7847843	9.9984814	48
13	73	9962185	4.8543084	9.9983546	47
14	84	9959276	4.9186777	9.9982278	46
15	96	9956368	4.9786040	9.9981009	45
16	109	9953459	5.0346614	9.9979740	44
17	123	9950550	5.0873192	9.9978470	43
18	138	9947641	5.1369663	9.9977201	42
19	154	9944732	5.1839282	9.9975930	41
20	170	9941823	5.2284810	9.9974660	40
21	187	9938914	5.2708594	9.9973389	39
22	205	9936005	5.3112661	9.9972118	38
23	224	9933096	5.3498762	9.9970846	37
24	244	9930187	5.3868430	9.9969574	36
25	265	9927279	5.4223002	9.9968302	35
26	287	9924370	5.4563669	9.9967029	34
27	309	9921461	5.4891474	9.9965756	33
28	332	9918552	5.5207359	9.9964483	32
29	356	9915643	5.5512156	9.9963209	31
30	381	9912735	5.5806620	9.9961935	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

89 DEGREES.

00 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	381	9912735	5.5806620	9.9961935	30
31	407	9909826	5.6091426	9.9960660	29
32	434	9906917	5.6367191	9.9959385	28
33	461	9904008	5.6634468	9.9958110	27
34	489	9901099	5.6893765	9.9956834	26
35	518	9898191	5.7145546	9.9955558	25
36	548	9895282	5.7390233	9.9954282	24
37	579	9892373	5.7628214	9.9953005	23
38	611	9889464	5.7859850	9.9951728	22
39	644	9886555	5.8085468	9.9950450	21
40	677	9883647	5.8305373	9.9949172	20
41	711	9880738	5.8519848	9.9947894	19
42	746	9877829	5.8729154	9.9946615	18
43	782	9874921	5.8933534	9.9945336	17
44	819	9872012	5.9133217	9.9944057	16
45	857	9869104	5.9328412	9.9942777	15
46	896	9866195	5.9519314	9.9941497	14
47	935	9863286	5.9706112	9.9940216	13
48	975	9860378	5.9888977	9.9938936	12
49	1016	9857469	6.0068070	9.9937654	11
50	1058	9854561	6.0243546	9.9936373	10
51	1101	9851652	6.0415546	9.9935091	9
52	1145	9848743	6.0584206	9.9933808	8
53	1189	9845835	6.0749654	9.9932526	7
54	1234	9842926	6.0912008	9.9931243	6
55	1280	9840018	6.1071384	9.9929959	5
56	1327	9837109	6.1227887	9.9928675	4
57	1375	9834201	6.1381620	9.9927391	3
58	1424	9831292	6.1532679	9.9926106	2
59	1473	9828384	6.1681156	9.9924821	1
60	1523	9825476	6.1827137	9.9923536	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

89 DEGREES.

1 DEGREE.					
M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	1523	9825476	6.1827137	9.9923536	60
1	1574	9822567	6.1970707	9.9922250	59
2	1626	9819659	6.2111938	9.9920964	58
3	1679	9816750	6.2250913	9.9919677	57
4	1733	9813842	6.2387696	9.9918391	56
5	1788	9810934	6.2522361	9.9917103	55
6	1843	9808025	6.2654968	9.9915816	54
7	1899	9805117	6.2785581	9.9914528	53
8	1956	9802208	6.2914259	9.9913240	52
9	2014	9799300	6.3041058	9.9911951	51
10	2073	9796392	6.3166033	9.9910662	50
11	2133	9793483	6.3289234	9.9909372	49
12	2194	9790575	6.3410714	9.9908082	48
13	2255	9787667	6.3530516	9.9906792	47
14	2317	9784759	6.3648689	9.9905501	46
15	2380	9781851	6.3765275	9.9904210	45
16	2444	9778943	6.3880317	9.9902919	44
17	2509	9776035	6.3993855	9.9901627	43
18	2575	9773127	6.4105928	9.9900335	42
19	2641	9770219	6.4216574	9.9899043	41
20	2708	9767311	6.4325826	9.9897750	40
21	2776	9764403	6.4433603	9.9896456	39
22	2845	9761495	6.4540294	9.9895163	38
23	2915	9758587	6.4645573	9.9893869	37
24	2986	9755679	6.4749592	9.9892575	36
25	3057	9752771	6.4852380	9.9891280	35
26	3129	9749863	6.4953965	9.9889985	34
27	3202	9746955	6.5054376	9.9888689	33
28	3276	9744047	6.5153639	9.9887393	32
29	3351	9741139	6.5251780	9.9886097	31
30	3427	9738231	6.5348825	9.9884801	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.
88 DEGREES.					

1 DEGREE.					
M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	3427	9738231	6.5348825	9.9884801	30
31	3504	9735323	6.5444797	9.9883503	29
32	3581	9732415	6.5539720	9.9882206	28
33	3659	9729507	6.5633617	9.9880908	27
34	3738	9726599	6.5726509	9.9879610	26
35	3818	9723692	6.5818418	9.9878311	25
36	3899	9720784	6.5909365	9.9877013	24
37	3981	9717876	6.5999368	9.9875713	23
38	4063	9714968	6.6088450	9.9874414	22
39	4146	9712060	6.6176626	9.9873114	21
40	4230	9709153	6.6263916	9.9871813	20
41	4315	9706245	6.6350337	9.9870512	19
42	4401	9703337	6.6435907	9.9869211	18
43	4488	9700430	6.6520642	9.9867910	17
44	4576	9697522	6.6604558	9.9866608	16
45	4664	9694615	6.6687671	9.9865305	15
46	4753	9691707	6.6769996	9.9864003	14
47	4843	9688800	6.6851548	9.9862700	13
48	4934	9685892	6.6932340	9.9861396	12
49	5026	9682985	6.7012388	9.9860092	11
50	5119	9680079	6.7091706	9.9858788	10
51	5213	9677170	6.7170304	9.9857484	9
52	5307	9674263	6.7248199	9.9856179	8
53	5402	9671355	6.7325400	9.9854873	7
54	5498	9668448	6.7401921	9.9853568	6
55	5595	9665541	6.7477774	9.9852261	5
56	5693	9662633	6.7552970	9.9850955	4
57	5792	9659726	6.7627520	9.9849648	3
58	5891	9656819	6.7701436	9.9848341	2
59	5991	9653912	6.7774728	9.9847033	1
60	6092	9651005	6.7847406	9.9845725	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.
88 DEGREES.					

2 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	6092	9651005	6.7847406	9.9845725	60
1	6194	9648098	6.7919482	9.9844417	59
2	6296	9645191	6.7990963	9.9843108	58
3	6400	9642284	6.8061860	9.9841799	57
4	6505	9639337	6.8132185	9.9840490	56
5	6610	9636470	6.8201944	9.9839179	55
6	6716	9633563	6.8271147	9.9837869	54
7	6823	9630656	6.8339812	9.9836559	53
8	6931	9627749	6.8407920	9.9835248	52
9	7040	9624842	6.8475506	9.9833936	51
10	7150	9621936	6.8542572	9.9832624	50
11	7260	9619029	6.8609122	9.9831312	49
12	7371	9616122	6.8675167	9.9830000	48
13	7483	9613215	6.8740712	9.9828686	47
14	7596	9610308	6.8805768	9.9827373	46
15	7710	9607402	6.8870338	9.9826059	45
16	7825	9604495	6.8934434	9.9824745	44
17	7940	9601588	6.8998058	9.9823431	43
18	8056	9598682	6.9061221	9.9822116	42
19	8173	9595775	6.9123926	9.9820801	41
20	8291	9592869	6.9186183	9.9819485	40
21	8410	9589962	6.9248004	9.9818169	39
22	8530	9587056	6.9309372	9.9816853	38
23	8651	9584149	6.9370316	9.9815536	37
24	8772	9581243	6.9430837	9.9814219	36
25	8894	9578337	6.9490938	9.9812901	35
26	9017	9575430	6.9550627	9.9811583	34
27	9141	9572524	6.9609886	9.9810265	33
28	9266	9569618	6.9668786	9.9808946	32
29	9392	9566712	6.9727272	9.9807627	31
30	9518	9563806	6.9785359	9.9806308	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

87 DEGREES.

2 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	9518	9563806	6.9785359	9.9806308	30
31	9645	9560900	6.9843062	9.9804988	29
32	9773	9557994	6.9900387	9.9803668	28
33	9902	9555088	6.9957334	9.9802347	27
34	10032	9552182	7.0013911	9.9801026	26
35	10163	9549276	7.0069920	9.9799704	25
36	10294	9546370	7.0125969	9.9798383	24
37	10426	9543464	7.0182460	9.9797060	23
38	10559	9540558	7.0236600	9.9795738	22
39	10693	9537652	7.0291390	9.9794415	21
40	10828	9534747	7.0345838	9.9793092	20
41	10964	9531841	7.0399946	9.9791768	19
42	11101	9528935	7.0453719	9.9790444	18
43	11239	9526030	7.0507160	9.9789119	17
44	11377	9523124	7.0560276	9.9787795	16
45	11516	9520219	7.0613068	9.9786469	15
46	11656	9517313	7.0665540	9.9785144	14
47	11797	9514408	7.0717698	9.9783817	13
48	11939	9511502	7.0769544	9.9782491	12
49	12082	9508595	7.0821082	9.9781164	11
50	12225	9505692	7.0872316	9.9779837	10
51	12369	9502786	7.0923238	9.9778509	9
52	12514	9499881	7.0973885	9.9777182	8
53	12660	9496976	7.1024228	9.9775853	7
54	12807	9494071	7.1074280	9.9774525	6
55	12955	9491166	7.1124044	9.9773195	5
56	13103	9488260	7.1173527	9.9771866	4
57	13252	9485355	7.1222728	9.9770536	3
58	13402	9482450	7.1271652	9.9769206	2
59	13553	9479545	7.1320302	9.9767875	1
60	13705	9476640	7.1368680	9.9766544	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

87 DEGREES.

3 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	13705	9476640	7.1368680	9.9766544	60
1	13857	9473735	7.1416791	9.9765212	59
2	14011	9470830	7.1464636	9.9763881	58
3	14165	9467925	7.1512219	9.9762548	57
4	14320	9465020	7.1559542	9.9761216	56
5	14476	9462116	7.1606609	9.9759883	55
6	14633	9459211	7.1653422	9.9758550	54
7	14791	9456306	7.1699984	9.9757216	53
8	14950	9453402	7.1746297	9.9755882	52
9	15109	9450497	7.1792365	9.9754547	51
10	15269	9447593	7.1838189	9.9753212	50
11	15430	9444688	7.1883773	9.9751877	49
12	15592	9441784	7.1929118	9.9750541	48
13	15755	9438880	7.1974228	9.9749205	47
14	15919	9435976	7.2019104	9.9747868	46
15	16083	9433072	7.2063750	9.9746531	45
16	16248	9430168	7.2108167	9.9745194	44
17	16414	9427264	7.2152358	9.9743856	43
18	16581	9424360	7.2196326	9.9742519	42
19	16749	9421456	7.2240071	9.9741180	41
20	16918	9418552	7.2283597	9.9739841	40
21	17088	9415648	7.2326906	9.9738502	39
22	17258	9412744	7.2370000	9.9737162	38
23	17429	9409840	7.2412881	9.9735822	37
24	17601	9406936	7.2455551	9.9734482	36
25	17774	9404033	7.2498013	9.9733141	35
26	17948	9401129	7.2540267	9.9731800	34
27	18123	9398225	7.2582317	9.9730458	33
28	18299	9395322	7.2624164	9.9729117	32
29	18475	9392418	7.2665810	9.9727774	31
30	18652	9389515	7.2707258	9.9726431	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

86 DEGREES.

3 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	18652	9389515	7.2707258	9.9726431	30
31	18830	9386611	7.2748508	9.9723088	29
32	19009	9383708	7.2789563	9.9723745	28
33	19189	9380804	7.2830425	9.9722401	27
34	19369	9377901	7.2871095	9.9721056	26
35	19550	9374998	7.2911576	9.9719712	25
36	19732	9372095	7.2951869	9.9718367	24
37	19925	9369192	7.2991975	9.9717021	23
38	20099	9366289	7.3031897	9.9715675	22
39	20284	9363386	7.3071636	9.9714329	21
40	20470	9360483	7.3111194	9.9712982	20
41	20657	9357580	7.3150572	9.9711635	19
42	20844	9354677	7.3189773	9.9710288	18
43	21032	9351774	7.3228797	9.9708940	17
44	2122	9348871	7.3267646	9.9707592	16
45	21411	9345969	7.3306322	9.9706243	15
46	21602	9343066	7.3344827	9.9704894	14
47	21793	9340163	7.3383161	9.9703545	13
48	21985	9337261	7.3421327	9.9702195	12
49	22178	9334358	7.3459326	9.9700845	11
50	22372	9331456	7.3497159	9.9699494	10
51	22567	9328553	7.3534828	9.9698143	9
52	22763	9325651	7.3572334	9.9696792	8
53	22960	9322749	7.3609678	9.9695440	7
54	23157	9319847	7.3646863	9.9694088	6
55	23355	9316945	7.3683888	9.9692735	5
56	23554	9314043	7.3720757	9.9691382	4
57	23754	9311141	7.3757469	9.9690029	3
58	23955	9308239	7.3794027	9.9688675	2
59	24157	9305337	7.3830431	9.9687321	1
60	24360	9302435	7.3866683	9.9685967	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

86 DEGREES.

4 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	24360	9302435	7.3866683	9.9685967	60
1	24563	9299533	7.3902785	9.9684611	59
2	24767	9296631	7.3938716	9.9683256	58
3	24972	9293730	7.3974540	9.9681900	57
4	25178	9290828	7.4010196	9.9680544	56
5	25385	9287927	7.4045706	9.9679188	55
6	25592	9285025	7.4081071	9.9677831	54
7	25800	9282124	7.4116293	9.9676474	53
8	26009	9279223	7.4151372	9.9675116	52
9	26219	9276322	7.4186311	9.9673758	51
10	26430	9273421	7.4221109	9.9672399	50
11	26642	9270520	7.4255767	9.9671040	49
12	26855	9267619	7.4290288	9.9669681	48
13	27069	9264718	7.4324672	9.9668321	47
14	27283	9261817	7.4358921	9.9666961	46
15	27498	9258916	7.4393034	9.9665601	45
16	27714	9256015	7.4417015	9.9664240	44
17	27931	9253114	7.4460862	9.9662879	43
18	28149	9250213	7.4494578	9.9661517	42
19	28367	9247312	7.4528163	9.9660155	41
20	28586	9244412	7.4561619	9.9658793	40
21	28806	9241511	7.4594946	9.9657430	39
22	29027	9238611	7.4628146	9.9656067	38
23	29249	9235710	7.4661219	9.9654703	37
24	29472	9232810	7.4694166	9.9653339	36
25	29696	9229910	7.4726989	9.9651974	35
26	29921	9227009	7.4759688	9.9650610	34
27	30146	9224109	7.4792265	9.9649244	33
28	30372	9221209	7.4824719	9.9647879	32
29	30599	9218309	7.4857052	9.9646512	31
30	30827	9215409	7.4889265	9.9645146	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

85 DEGREES.

4 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	30827	9215409	7.4889265	9.9645146	30
31	31056	9212509	7.4921359	9.9643779	29
32	31285	9209609	7.4953353	9.9642412	28
33	31515	9206709	7.4985193	9.9641044	27
34	31746	9203809	7.5016934	9.9639676	26
35	31978	9200910	7.5048560	9.9638308	25
36	32211	9198010	7.5080071	9.9636939	24
37	32445	9195111	7.5111468	9.9635570	23
38	32680	9192211	7.5142751	9.9634200	22
39	32915	9189312	7.5173922	9.9632830	21
40	33151	9186413	7.5204982	9.9631460	20
41	33388	9183514	7.5235930	9.9630089	19
42	33626	9180615	7.5266769	9.9628718	18
43	33865	9177716	7.5297498	9.9627346	17
44	33405	9174817	7.5328119	9.9625974	16
45	34345	9171918	7.5358632	9.9624601	15
46	34586	9169019	7.5389038	9.9623229	14
47	34828	9166120	7.5419338	9.9621855	13
48	35071	9163222	7.5449532	9.9620482	12
49	35315	9610323	7.5479021	9.9619108	11
50	35560	9157424	7.5509607	9.9617733	10
51	35806	9154526	7.5539489	9.9616358	9
52	36052	9151628	7.5509268	9.9614983	8
53	36299	9148729	7.5598946	9.9613607	7
54	36547	9145831	7.5628522	9.9612232	6
55	36796	9142933	7.5657997	9.9610855	5
56	27046	9140035	7.5687373	9.9609478	4
57	37297	9137137	7.5716650	9.9608101	3
58	37548	9134239	7.5745828	9.9606723	2
59	37800	9131341	7.5774908	9.9605345	1
60	38053	9128443	7.5803891	9.9603967	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

85 DEGREES.

5 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	38053	9128443	7.5803891	9.9603967	60
1	38307	9125545	7.5832777	9.9602588	59
2	38562	9122647	7.5861568	9.9601209	58
3	38817	9119750	7.5890263	9.9599829	57
4	39074	9116852	7.5918864	9.9598449	56
5	39331	9113955	7.5947322	9.9597068	55
6	39589	9111057	7.5975783	9.9595688	54
7	39848	9108160	7.6004103	9.9594306	53
8	40108	9105263	7.6032331	9.9592925	52
9	40369	9102366	7.6060468	9.9591542	51
10	40630	9099469	7.6088513	9.9590160	50
11	40893	9096572	7.6116468	9.9588777	49
12	41156	9093675	7.6144333	9.9587394	48
13	41420	9090778	7.6172109	9.9586010	47
14	41685	9087881	7.6199796	9.9584626	46
15	41951	9084984	7.6227395	9.9583241	45
16	42217	9082087	7.6254906	9.9581857	44
17	42485	9079191	7.6282330	9.9580471	43
18	42753	9076294	7.6309668	9.9579086	42
19	43022	9073398	7.6336920	9.9577699	41
20	43292	9070502	7.6364086	9.9576313	40
21	43563	9067605	7.6391167	9.9574926	39
22	43835	9064709	7.6418164	9.9573539	38
23	44107	9061813	7.6445078	9.9572151	37
24	44380	9058917	7.6471908	9.9570763	36
25	44655	9056021	7.6498655	9.9569374	35
26	44930	9053125	7.6525320	9.9567985	34
27	45205	9050229	7.6551903	9.9566596	33
28	45482	9047333	7.6578404	9.9565206	32
29	45760	9044437	7.6604825	9.9563816	31
30	46038	9041542	7.6631166	9.9562425	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M

84 DEGREES.

5 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	46038	9041542	7.6631166	9.9562425	30
31	46317	9038646	7.6657427	9.9561034	29
32	46597	9035751	7.6683608	9.9559643	28
33	46878	9032856	7.6709711	9.9558251	27
34	47160	9029961	7.6735735	9.9556859	26
35	47443	9027066	7.6761682	9.9555466	25
36	47726	9024171	7.6787550	9.9554073	24
37	48010	9021276	7.6813342	9.9552680	23
38	48295	9018381	7.6839058	9.9551286	22
39	48581	9015486	7.6864697	9.9549891	21
40	48868	9012592	7.6890260	9.9548497	20
41	49156	9009697	7.6915749	9.9547102	19
42	49444	9006802	7.6941162	9.9545706	18
43	49734	9003908	7.6966502	9.9544310	17
44	50024	9001013	7.6991767	9.9542914	16
45	50315	8998119	7.7016959	9.9541517	15
46	50607	8995225	7.7042078	9.9540120	14
47	50900	8992331	7.7067124	9.9538723	13
48	51193	8989437	7.7092098	9.9537325	12
49	52487	8986543	7.7117001	9.9535926	11
50	51783	8983649	7.7141832	9.9534528	10
51	52079	8980755	7.7166592	9.9533128	9
52	52375	8977861	7.7191281	9.9531729	8
53	52673	8974968	7.7215900	9.9530329	7
54	52972	8972074	7.7240450	9.9528929	6
55	53271	8969181	7.7264930	9.9527528	5
56	53572	8966287	7.7289341	9.9526127	4
57	53873	8963394	7.7313683	9.9524725	3
58	54175	8960501	7.7337658	9.9523323	2
59	54477	8957608	7.7362164	9.9521920	1
60	54781	8954715	7.7386303	9.9520518	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

84 DEGREES.

6 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	54781	8954715	7.7386303	9.9520518	60
1	55086	8951822	7.7410375	9.9519114	59
2	55391	8948929	7.7434380	9.9517711	58
3	55697	8946036	7.7458319	9.9516307	57
4	56004	8943143	7.7482192	9.9514902	56
5	56312	8940251	7.7505999	9.9513497	55
6	56621	8937358	7.7529742	9.9512092	54
7	56931	8934466	7.7553419	9.9510686	53
8	57241	8931574	7.7577031	9.9509280	52
9	57552	8928682	7.7600580	9.9507874	51
10	57864	8925790	7.7624064	9.9506467	50
11	58177	8922898	7.7647485	9.9505059	49
12	58491	8920006	7.7670843	9.9503652	48
13	58806	8917114	7.7694138	9.9502243	47
14	59121	8914222	7.7717371	9.9500835	46
15	59437	8911331	7.7740541	9.9499426	45
16	59754	8908439	7.7763649	9.9498016	44
17	60072	8905548	7.7786696	9.9496606	43
18	60391	8902656	7.7809682	9.9495196	42
19	60710	8899765	7.7832607	9.9493785	41
20	61030	8896874	7.7855472	9.9492375	40
21	61351	8893983	7.7878276	9.9490963	39
22	61673	8891092	7.7901020	9.9489551	38
23	61996	8888201	7.7923705	9.9488139	37
24	62320	8885310	7.7946331	9.9486716	36
25	62645	8882420	7.7968897	9.9485313	35
26	62971	8879529	7.7991405	9.9483899	34
27	63297	8876639	7.8013855	9.9482485	33
28	63624	8873748	7.8036246	9.9481071	32
29	63952	8870858	7.8058580	9.9479656	31
30	64281	8867968	7.8080856	9.9478241	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

83 DEGREES.

6 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	64281	8867968	7.8080856	9.9478241	30
31	64611	8865078	7.8103076	9.9476825	29
32	64942	8862188	7.8123237	9.9475409	28
33	65273	8859298	7.8147343	9.9473993	27
34	65605	8856408	7.8169392	9.9472576	26
35	65938	8853518	7.8191386	9.9471159	25
36	66272	8850628	7.8213323	9.9469741	24
37	66608	8847739	7.8235205	9.9468323	23
38	66943	8844849	7.8257032	9.9466904	22
39	67279	8841960	7.8278804	9.9465485	21
40	67616	8839071	7.8300522	9.9464066	20
41	67954	8836182	7.8322185	9.9462646	19
42	68293	8833293	7.8343794	9.9461126	18
43	68633	8830404	7.8365349	9.9459805	17
44	68974	8827515	7.8386851	9.9458385	16
45	69315	8824626	7.8408299	9.9456963	15
46	69657	8821737	7.8429695	9.9455541	14
47	70000	8818849	7.8451037	9.9454119	13
48	70344	8815960	7.8472327	9.9452696	12
49	70689	8813072	7.8493565	9.9451273	11
50	71035	8810184	7.8514751	9.9449850	10
51	71382	8807296	7.8535885	9.9448425	9
52	71729	8804408	7.8556968	9.9447001	8
53	72077	8801520	7.8577949	9.9445576	7
54	72426	8798632	7.8598980	9.9444151	6
55	72776	8795745	7.8619910	9.9442726	5
56	73127	8792857	7.8640789	9.9441300	4
57	73479	8789969	7.8661618	9.9439873	3
58	73831	8787082	7.8682397	9.9438446	2
59	74184	8784194	7.8703126	9.9437019	1
60	74539	8781307	7.8723806	9.9435591	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

83 DEGREES.

7 DEGREES.

M.	Natural Verſed Sine.	Natural Co-Verſed Sine.	Logarithm Verſed Sine.	Logarithm Co-Verſed Sine.	
0	74539	8781307	7.8723806	9.9435591	60
1	74894	8778420	7.8744436	9.9434163	59
2	75250	8775533	7.8765017	9.9432735	58
3	75607	8772646	7.8785550	9.9431306	57
4	75964	8779759	7.8806033	9.9429876	56
5	76322	8766872	7.8826469	9.9428446	55
6	76681	8763985	7.8846856	9.9427016	54
7	77041	8761099	7.8867196	9.9425586	53
8	76681	8758212	7.8887487	9.9424155	52
9	77764	8755326	7.8907784	9.9422723	51
10	78126	8752440	7.8927928	9.9421291	50
11	78484	8759554	7.8948078	9.9419859	49
12	78853	8746668	7.8968181	9.9418426	48
13	79218	8743782	7.8988238	9.9416993	47
14	79584	8740896	7.9008248	9.9415560	46
15	79951	8738010	7.9028212	9.9414125	45
16	80318	8735124	7.9048130	9.9412691	44
17	80686	8732239	7.9068002	9.9411256	43
18	81055	8739353	7.9087829	9.9409822	42
19	81425	8726468	7.9107610	9.9408385	41
20	81796	8723583	7.9127346	9.9406949	40
21	82168	8720698	7.9147038	9.9405513	39
22	82541	8717813	7.9166684	9.9404076	38
23	82914	8714928	7.9186286	9.9402638	37
24	83288	8714928	7.9205844	9.9401201	36
25	83663	8712043	7.9225358	9.9399762	35
26	84039	8709159	7.9244827	9.9398324	34
27	84416	8706274	7.9264253	9.9396885	33
28	84794	8703390	7.9283636	9.9395445	32
29	85172	8699505	7.9302975	9.9394005	31
30	85551	8697622	7.9322271	9.9392565	30
	Natural Co-Verſed Sine.	Natural Verſed Sine.	Logarithm Co-Verſed Sine.	Logarithm Verſed Sine.	M.

82 DEGREES.

7 DEGREES.

M.	Natural Verſed Sine.	Natural Co-Verſed Sine.	Logarithm Verſed Sine.	Logarithm Co-Verſed Sine.	
30	85551	8697622	7.9322271	9.9392565	30
31	85931	8694738	7.9341523	9.9391224	29
32	86312	8691854	7.9360734	9.9389083	28
33	86694	8688970	7.9379901	9.9388241	27
34	87077	8686086	7.9399027	9.9386800	26
35	87460	8683202	7.9418110	9.9385357	25
36	87844	8677436	7.9437151	9.9383914	24
37	88229	8674553	7.9456150	9.9382411	23
38	88615	8671670	7.9475107	9.9381027	22
39	89002	8668787	7.9494023	9.9379583	21
40	89391	8665904	7.9512898	9.9378139	20
41	89779	8663021	7.9531732	9.9376693	19
42	90168	8660138	7.9550525	9.9375248	18
43	90558	8657256	7.9569276	9.9373802	17
44	90949	8654373	7.9587988	9.9372356	16
45	91341	8651491	7.9606663	9.9370909	15
46	91734	8648608	7.9625290	9.9369462	14
47	92124	8645726	7.9643880	9.9368015	13
48	92521	8642844	7.9662431	9.9366567	12
49	92916	8639962	7.9680942	9.9365118	11
50	93312	8637080	7.9699414	6.9363670	10
51	93709	8634198	7.9717846	9.9362220	9
52	94107	8631317	7.9736239	9.9360771	8
53	94506	8628436	7.9754593	9.9359321	7
54	94905	8625554	7.9772908	9.9357870	6
55	95305	8622673	7.9791184	9.9356419	5
56	95706	8619792	7.9809422	99.354968	4
57	96108	8616911	7.9827621	9.9353156	3
58	96511	8614030	7.9845782	9.9352064	2
59	96915	8611149	7.9863905	9.9350611	1
60	97319	8608269	7.9881990	9.9349158	0
	Natural Co-Verſed Sine.	Natural Verſed Sine.	Logarithm Co Verſed Sine.	Logarithm Verſed Sine	M.

82 DEGREES.

8 DEGREES.					
M.	*Natural Versed Sine.*	*Natural Co-Versed Sine.*	*Logarithm Versed Sine.*	*Logarithm Co-Versed Sine.*	
0	97319	8608269	7.9881990	9.9349158	60
1	97724	8605388	7.9900038	9.9347705	59
2	98130	8602508	7.9918047	9.9346251	58
3	98537	8599627	7.9936020	9.9344756	57
4	98935	8596747	7.9953955	9.9343342	56
5	99354	8593867	7.9971853	9.9341886	55
6	99763	8590987	7.9989713	9.9340431	54
7	100173	8588107	8.0007537	9.9338975	53
8	100584	8585228	8.0025325	9.9337526	52
9	100996	8582348	8.0043076	9.9336061	51
10	101409	8579469	8.0060790	9.9334604	50
11	101823	8576590	8.0078468	9.9333146	49
12	102238	8573711	8.0096110	9.9331688	48
13	102653	8570832	8.0113716	9.9330229	47
14	103069	8567953	8.0131287	9.9328771	46
15	103486	8565074	8.0148822	9.9327311	45
16	103904	8562195	8.0166321	9.9325851	44
17	104323	8559316	8.0183785	9.9324391	43
18	104743	8556438	8.0201213	9.9322930	42
19	105163	8553559	8.0218607	9.9321469	41
20	105584	8550681	8.0235965	9.9320007	40
21	106006	8547803	8.0253289	9.9318545	39
22	106429	8544925	8.0270578	9.9317083	38
23	106853	8542047	8.0287833	9.9315620	37
24	107277	8539169	8.0305053	9.9314156	36
25	107702	8536292	8.0322239	9.9312692	35
26	108128	8533414	8.0339391	9.9311228	34
27	108555	8530537	8.0356508	9.9309764	33
28	102983	8527660	8.0373592	9.9308299	32
29	109182	8524783	8.0390643	9.9306833	31
30	109841	8521906	8.0407659	9.9305367	30
	Natural Co-Versed Sine.	*Natural Versed Sine.*	*Logarithm Co-Versed Sine.*	*Logarithm Versed Sine.*	M.
81 DEGREES.					

8 DEGREES.					
M.	*Natural Versed Sine.*	*Natural Co-Versed Sine.*	*Logarithm Versed Sine.*	*Logarithm Co-Versed Sine.*	
30	109841	8521906	8.0407659	9.9305367	30
31	110271	8519029	8.0424642	9.9303901	29
32	110702	8516152	8.0441592	9.9302434	28
33	111134	8513276	8.0458509	9.9300967	27
34	111567	8510399	8.0475393	9.9299499	26
35	112001	8507523	8.0492243	9.9298031	25
36	112436	8504647	8.0509061	9.9296563	24
37	112872	8501771	8.0525847	9.9295094	23
38	113308	8498895	8.0542599	9.9293624	22
39	113745	8496019	8.0559319	9.9292154	21
40	114183	8493143	8.0576007	9.9290684	20
41	114622	8490267	8.0592663	9.9289213	19
42	115062	8487392	8.0609286	9.9287743	18
43	115502	8484516	8.0625878	9.9286271	17
44	115943	8481641	8.0641438	9.9284799	16
45	116385	8478766	8.0658966	9.9283326	15
46	116828	8475891	8.0675463	9.9281854	14
47	117272	8473016	8.0691928	9.9280380	13
48	117717	8470141	8.0708362	9.9278907	12
49	118162	8467266	8.0724764	9.9277432	11
50	118608	8464392	8.0741136	9.9275958	10
51	119055	8461518	8.0757476	9.9274483	9
52	119503	8458644	8.0773786	9.9273008	8
53	119952	8455770	8.0790065	9.9271531	7
54	120402	8452896	8.0806313	9.9270055	6
55	120852	8450022	8.0822531	9.9268578	5
56	121303	8447148	8.0838718	9.9267101	4
57	121755	8444275	8.0854976	9.9265624	3
58	122208	8441401	8.0871002	9.9264146	2
59	122662	8438528	8.0887099	9.9262667	1
60	123117	8435655	8.0903166	9.9261188	0
	Natural Co-Versed Sine.	*Natural Versed Sine.*	*Logarithm Co-Versed Sine.*	*Logarithm Versed Sine.*	M.
81 DEGREES.					

9 DEGREES.					
M.	*Natural Versed Sine.*	*Natural Co-Versed Sine.*	*Logarithm Versed Sine.*	*Logarithm Co-Versed Sine.*	
0	123117	8435655	8.0903166	9.9261188	60
1	123573	8432782	8.0919 03	9.9259709	59
2	124029	8429909	8.0935210	9.9258229	58
3	124486	8427036	8.0951188	9.9256749	57
4	124944	8424163	8.0967136	9.9255268	56
5	125403	8411291	8.0983055	9.9253787	55
6	125863	8418419	8.0998944	9.9252306	54
7	126323	8415547	8.1014804	9.9250823	53
8	126784	8412675	8.1030635	9.9249341	52
9	127246	8409803	8.1046437	9.9247858	51
10	127709	8406931	8.1062211	9.9246375	50
11	128173	8404059	8.1077955	9.9244891	49
12	128638	8491188	8.1093671	9.9243407	48
13	128103	8398316	8.1109358	9.9241922	47
14	129569	8395445	8.1125017	9.9240437	46
15	130036	8392574	8.1140647	9.9238956	45
16	130544	8389703	8.1156249	9.9237466	44
17	130973	8386832	8.1171823	9.9235979	43
18	131443	8383962	8.1187369	9.9234493	42
19	131915	8381091	8.1202887	9.9233005	41
20	132384	8378221	8.1218377	9.9231518	40
21	132856	8375351	8.1233840	9.9220030	39
22	133329	8372481	8.1249274	9.9228541	38
23	133803	8369611	8.1264681	9.9227052	37
24	134278	8366741	8.1280061	9.9225563	36
25	134754	8363871	8.1295413	9.9234073	35
26	135230	8361001	8.1310738	9.9222583	34
27	135707	8358132	8.1326036	9.9221092	33
28	136185	8355262	8.1341307	9.9219601	32
29	136664	8352393	8.1356551	9.9218109	31
30	137144	8349524	8.1371768	9.9216617	30
	Natural Co-Versed Sine.	*Natural Versed Sine.*	*Logarithm Co-Versed Sine.*	*Logarithm Versed Sine.*	M.
80 DEGREES.					

9 DEGREES.					
M.	*Natural Versed Sine.*	*Natural Co-Versed Sine.*	*Logarithm Versed Sine.*	*Logarithm Co-Versed Sine.*	
30	137144	8349524	8.1311768	9.9216617	30
31	137624	8346655	8.1386958	9.9215124	29
32	138105	8343786	8.1402121	9.9213632	28
33	138587	8340918	8.1417258	9.9212138	27
34	139070	8338049	8.1432368	9.9210644	26
35	139554	8335181	8.1447452	9.9209150	25
36	140039	8332313	8.1462510	9.9207656	24
37	140525	8329445	8.1477541	9.9206160	23
38	141011	8326577	8.1492546	9.9204665	22
39	141498	8323709	8.1507525	9.9203169	21
40	141986	8320841	8.1522478	9.9201672	20
41	142475	8317973	8.1537405	9.9200175	19
42	142965	8315106	8.1552307	9.9198678	18
43	143456	8312239	8.1567182	9.9197180	17
44	143947	8309372	8.1582032	9.9195682	16
45	144439	8306505	8.1596857	9.9194183	15
46	144932	8303638	8.1611656	9.9192684	14
47	145426	8300771	8.1626430	9.9191184	13
48	145921	8297905	8.1641178	9.9189685	12
49	146417	8295038	8.1655902	9.9188184	11
50	146913	8292172	8.1670600	9.9186683	10
51	147410	8289306	8.1685273	9.9185182	9
52	147908	8286440	8.1699921	9.9183680	8
53	148407	8283574	8.1714545	9.9182278	7
54	148907	8280708	8.1729144	9.9180675	6
55	149407	8277843	8.1743717	9.9179172	5
56	149908	8274978	8.1758267	9.9177669	4
57	150410	8272113	8.1772792	9.9176164	3
58	150913	8269248	8.1787292	9.9174660	2
59	151417	8266383	8.1801768	9.9173155	1
60	151922	8263518	8.1816220	9.9171650	0
	Natural Co-Versed Sine.	*Natural Versed Sine.*	*Logarithm Co-Versed Sine.*	*Logarithm Versed Sine.*	M.
80 DEGREES.					

10 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	151922	8263518	8.1816220	9.9171650	60
1	152428	8260653	8.1830648	9.9170144	59
2	152934	8257789	8.1845051	9.9168638	58
3	153441	8254925	8.1859431	9.9167131	57
4	153949	8252061	8.1873786	9.9165624	56
5	154450	8249197	8.1888118	9.9164116	55
6	154968	8246333	8.1902426	9.9162609	54
7	155479	8243469	8.1916710	9.9161100	53
8	155990	8240606	8.1930971	9.9159591	52
9	156502	8237742	8.1945208	9.9158082	51
10	157015	8234879	8.1959421	9.9156572	50
11	157529	8232016	8.1973611	9.9155062	49
12	158044	8229153	8.1987778	9.9153551	48
13	158560	8226290	8.2001921	9.9152040	47
14	159076	8223427	8.2016042	9.9150528	46
15	159593	8220565	8.2030139	9.9149016	45
16	160111	8217702	8.2044213	9.9147504	44
17	160630	8214840	8.2058264	9.9145991	43
18	161150	8211978	8.2072293	9.9144478	42
19	161671	8209116	8.2086298	9.9142964	41
20	162192	8206254	8.2100281	9.9141450	40
21	162714	8203392	8.2114241	9.9139935	39
22	163237	8200531	8.2128179	9.9138420	38
23	163761	8193669	8.2142094	9.9136904	37
24	164286	8194808	8.2155987	9.9135388	36
25	164811	8191946	8.2169857	9.9133871	35
26	165337	8189086	8.2183705	9.9132355	34
27	165864	8186226	8.2197531	9.9130837	33
28	166392	8183366	8.2211334	9.9129319	32
29	166921	8180505	8.2225116	9.9127801	31
30	167451	8177645	8.2238875	9.9126282	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M

79 DEGREES.

10 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	167451	8177645	8.2238875	9.9126282	30
31	167981	8174785	8.2252613	9.9124763	29
32	168512	8171925	8.2266329	9.9123244	28
33	169044	8169065	8.2280023	9.9121723	27
34	169577	8166205	8.2293695	9.9120203	26
35	170111	8163346	8.2307345	9.9118682	25
36	170646	8160487	8.2320974	9.9117161	24
37	171182	8157628	8.2334581	9.9115638	23
38	171718	8154769	8.2348167	9.9114116	22
39	172255	8151910	8.2361732	9.9112593	21
40	172793	8149051	8.2375275	9.9111070	20
41	173332	8146192	8.2388797	9.9109546	19
42	173872	8143334	8.2402297	9.9108022	18
43	174413	8140476	8.2415737	9.9106498	17
44	174954	8137618	8.2429235	9.9104973	16
45	175496	8134760	8.2442673	9.9103447	15
46	176039	8131902	8.2456089	9.9101921	14
47	176583	8129044	8.2469485	9.9100395	13
48	177128	8126187	8.2482860	9.9098868	12
49	177673	8123330	8.2496214	9.9097341	11
50	178219	8120473	8.2509547	9.9095813	10
51	178766	8117616	8.2522860	9.9094285	9
52	179314	8114759	8.2536152	9.9092756	8
53	179863	8111902	8.2549424	9.9091227	7
54	180413	8109046	8.2562675	9.9089697	6
55	180963	8106190	8.2575906	9.9088167	5
56	181514	8103334	8.2589117	99.086637	4
57	182066	8100478	8.2602307	9.9085106	3
58	182619	8097622	8.2615477	9.9083575	2
59	183173	8094766	8.2628626	9.9082043	1
60	183728	8091910	8.2641757	9.9080510	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

79 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
	11 DEGREES.				
0	183728	8091910	8.2641757	9.9080510	60
1	184284	8089055	8.2654867	9.9078977	59
2	184840	8086200	8.2667957	9.9077445	58
3	185397	8083345	8.2681028	9.9075911	57
4	185955	8080490	8.2694078	9.9074377	56
5	186514	8077635	8.2707169	9.9072842	55
6	187074	8074780	8.2720119	9.9071307	54
7	187634	8071926	8.2733111	9.9069771	53
8	188195	8069072	8.2746082	9.9068236	52
9	188757	8066218	8.2759035	9.9066699	51
10	189320	8063364	8.2771967	9.9065163	50
11	189884	8060510	8.2784880	9.9063625	49
12	190449	8057656	8.2797774	9.9062087	48
13	191014	8054803	8.2810649	9.9060549	47
14	191580	8051950	8.2823504	9.9059011	46
15	192147	8049097	8.2836341	9.9057471	45
16	192715	8046244	8.2849158	9.9055932	44
17	193284	8043391	8.2861956	9.9054392	43
18	193853	8040538	8.2874735	9.9052851	42
19	194423	8037686	8.2887495	9.9051310	41
20	194994	8034834	8.2900236	9.9049769	40
21	195566	8031982	8.2912958	9.9048227	39
22	196139	8029130	8.2925661	9.9046685	38
23	196713	8026278	8.2938346	9.9045142	37
24	197288	8023426	8.2951012	9.9043599	36
25	197863	8020575	8.2963660	9.9042055	35
26	198439	8017724	8.2976289	9.9040511	34
27	199016	8014873	8.2988899	9.9038966	33
28	199594	8012022	8.3001491	9.9037421	32
29	200174	8009171	8.3014064	9.9035876	31
30	200753	8006321	8.3026619	9.9034330	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine	M.
	78 DEGREES.				

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
	11 DEGREES.				
30	200753	8006321	8.3026619	9.9034330	30
31	201333	8003470	8.3039156	9.9032783	29
32	201914	8000620	8.3051675	9.9031236	28
33	202496	7997770	8.3064175	9.9029689	27
34	203079	7994920	8.3076657	9.9028141	26
35	203663	7992070	8.3089122	9.9026593	25
36	204247	7989220	8.3101568	9.9025044	24
37	204832	7986371	8.3113996	9.9023495	23
38	205418	7983522	8.3126406	9.9021945	22
39	206005	7980673	8.3138798	9.9020395	21
40	206593	7977824	8.3151172	9.9018845	20
41	207182	7974975	8.3163529	9.9017293	19
42	207772	7972126	8.3175868	9.9015142	18
43	208362	7969278	8.3188189	9.9014190	17
44	208953	7966430	8.3200493	9.9012638	16
45	209545	7963582	8.3212779	9.9011085	15
46	210138	7960734	8.3225047	9.9009531	14
47	210732	7957886	8.3237298	9.9007977	13
48	211326	7955038	8.3249532	9.9006423	12
49	211921	7952191	8.3261748	9.9004868	11
50	212517	7949344	8.3273947	9.9003313	10
51	213114	7946497	8.3286128	9.8901758	9
52	213712	7943650	8.3298292	9.8900202	8
53	214311	7940803	8.3310439	9.8998645	7
54	214910	7937957	8.3322569	9.8997088	6
55	215510	7935111	8.3334682	9.8995530	5
56	216111	7932265	8.3346778	9.8993973	4
57	216713	7929419	8.3358857	9.8992414	3
58	217316	7926573	8.3370918	9.8990855	2
59	217920	7923728	8.3382963	9.8989296	1
60	218524	7920883	8.3394991	9.8987736	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.
	78 DEGREES.				

12 DEGREES.					
M.	*Natural Versed Sine.*	*Natural Co-Versed Sine.*	*Logarithm Versed Sine.*	*Logarithm Co-Versed Sine.*	
0	218524	7920883	8.3394991	9.8987736	60
1	219129	7918038	8.3407002	9.8986176	59
2	219735	7915193	8.3418997	9.8984615	58
3	220342	7912348	8.3430975	9.8983054	57
4	220950	7909503	8.3442936	9.8981492	56
5	221558	7906658	8.3454880	9.8979930	55
6	222167	7903814	8.3466808	9.8978367	54
7	222777	7900970	8.3478719	9.8976804	53
8	223388	7898126	8.3490614	9.8975241	52
9	224000	7895282	8.3502492	9.8973676	51
10	224613	7892438	8.3514354	9.8972112	50
11	225227	7889595	8.3526200	9.8970547	49
12	225841	7886752	8.3538029	9.8968982	48
13	226456	7883909	8.3549842	9.8967416	47
14	227072	7881066	8.3561639	9.8965850	46
15	227689	7878223	8.3573419	9.8964283	45
16	228307	7875380	8.3585184	9.8962716	44
17	229925	7872538	8.3596932	9.8961148	43
18	229544	7869696	8.3608664	9.8959580	42
19	230164	7866854	8.3620380	9.8958011	41
20	230785	7864012	8.3632081	9.8956442	40
21	231407	7861170	8.3643765	9.8954872	39
22	232030	7858329	8.3655434	9.8953302	38
23	232653	7855488	8.3667086	9.8951731	37
24	233277	7852647	8.3678723	9.8950161	36
25	233902	7849806	8.3690344	9.8948589	35
26	234528	7846965	8.3701950	9.8947017	34
27	235155	7844124	8.3713540	9.8945445	33
28	235783	7841284	8.3725114	9.8943872	32
29	236411	7838444	8.3736672	9.8942298	31
30	237040	7835604	8.3748215	9.8940725	30
	Natural Co-Versed Sine.	*Natural Versed Sine.*	*Logarithm Co-Versed Sine.*	*Logarithm Versed Sine*	M.
77 DEGREES.					

12 DEGREES.					
M.	*Natural Versed Sine.*	*Natural Co-Versed Sine.*	*Logarithm Versed Sine.*	*Logarithm Co-Versed Sine.*	
30	237040	7835604	8.3748215	9.8940725	30
31	237670	7832764	8.3759743	9.8939150	29
32	238301	7829924	8.3771255	9.8937576	28
33	238933	7827084	8.3782751	9.8936000	27
34	239565	7824245	8.3794232	9.8934425	26
35	240198	7821406	8.3805698	9.8932848	25
36	240832	7818567	8.3817149	9.8931272	24
37	241467	7815728	8.3828584	9.8929695	23
38	242103	7812889	8.3840004	9.8928117	22
39	242740	7810051	8.3851409	9.8926539	21
40	244377	7807213	8.3862799	9.8924961	20
41	244015	7804375	8.3874174	9.8923381	19
42	244654	7801537	8.3885533	9.8921802	18
43	245294	7798700	8.3896878	9.8920222	17
44	245935	7795863	8.3908207	9.8918642	16
45	246577	7793026	8.3919522	9.8917061	15
46	247219	7790189	8.3930822	9.8915480	14
47	247862	7787352	8.3942107	9.8913898	13
48	248506	7784515	8.3953377	9.8912316	12
49	249151	7781678	8.3964638	9.8910733	11
50	249797	7778842	8.3975873	9.8909150	10
51	250443	7776006	8.3987098	9.8907566	9
52	251090	7773170	8.3998310	9.8905982	8
53	251738	7770334	8.4009506	9.8904397	7
54	252387	7767498	8.4020688	9.8902812	6
55	253037	7764963	8.4031855	9.8901226	5
56	253688	7761828	84.043008	9.8899640	4
57	254340	7758993	84.054147	9.8898054	3
58	254992	7756158	84.065270	9.8896467	2
59	255645	7753323	84.076380	9.8894879	1
60	256300	7750489	84.087475	9.8893291	0
	Natural Co-Versed Sine.	*Natural Versed Sine.*	*Logarithm Co-Versed Sine.*	*Logarithm Versed Sine.*	M.
77 DEGREES.					

13 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	256300	7750489	8.4087475	9.8893291	60
1	256955	7747655	8.4098556	9.8891703	59
2	257611	7744821	8.4109622	9.8890114	58
3	258267	7741987	8.4120675	9.8888524	57
4	258924	7739153	8.4131713	9.8886935	56
5	259582	7736320	8.4142736	9.8885344	55
6	260241	7733487	8.4153746	9.8883754	54
7	260901	7730654	8.4164741	9.8882162	53
8	261561	7727821	8.4175723	9.8880571	52
9	262222	7724988	8.4186690	9.8878978	51
10	262884	7722156	8.4197644	9.8877386	50
11	263547	7719324	8.4208583	9.8875792	49
12	264211	7716492	8.4219508	9.8874199	48
13	264876	7713660	8.4230420	9.8872604	47
14	265541	7710828	8.4241318	9.8871010	46
15	266207	7707996	8.4252280	9.8869415	45
16	266874	7705165	8.4263072	9.8867819	44
17	267542	7702334	8.4273928	9.8866223	43
18	268211	7699503	8.4284770	9.8864627	42
19	268880	7696672	8.4295600	9.8863029	41
20	269550	7693841	8.4306414	9.8861432	40
21	270221	7691011	8.4317216	9.8859834	39
22	270893	7688181	8.4328004	9.8858236	38
23	271566	7685351	8.4338778	9.8856637	37
24	272240	7682521	8.4349539	9.8855038	36
25	272915	7679691	8.4360286	9.8853437	35
26	273591	7676862	8.4371020	9.8851837	34
27	274267	7674033	8.4381740	9.8850236	33
28	274944	7671204	8.4392447	9.8848635	32
29	275622	7668375	8.4403141	9.8847033	31
30	276301	7665546	8.4413821	9.8845431	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine	M.

76 DEGREES.

13 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	276301	7665546	8.4413821	9.8845431	30
31	276980	7662718	8.4424488	9.8843828	29
32	277660	7659890	8.4435142	9.8842225	28
33	278341	7657062	8.4445743	9.8840621	27
34	279023	7654234	8.4456410	9.8839017	26
35	279706	7651406	8.4467024	9.8837412	25
36	280390	7648579	8.4477625	9.8835807	24
37	281074	7645752	8.4488213	9.8834202	23
38	281759	7642925	8.4498788	9.8832596	22
39	282445	7640098	8.4509350	9.8830989	21
40	283132	7637271	8.4519898	9.8829382	20
41	283820	7634445	8.4530434	9.8827774	19
42	284509	7631619	8.4540957	9.8826167	18
43	285198	7628793	8.4551467	9.8824558	17
44	285888	7625967	8.4561964	9.8822949	16
45	286579	7623141	8.4572448	9.8821339	15
46	287271	7620316	8.4582920	9.8819730	14
47	287964	7617491	8.4593378	9.8818119	13
48	288657	7614666	8.4603824	9.8816508	12
49	289351	7611841	8.4614257	9.8814897	11
50	290046	7609017	8.4624677	9.8813285	10
51	290742	7606192	8.4635085	9.8811672	9
52	291439	7603368	8.4645480	9.8810060	8
53	292137	7600544	8.4655863	9.8808446	7
54	292835	7597720	8.4666233	9.8806833	6
55	293534	7594896	8.4676461	9.8805218	5
56	294234	7592073	8.4686935	9.8803604	4
57	294935	7589250	8.4697269	9.8801988	3
58	295637	7586427	8.4707587	9.8800372	2
59	296340	7583604	8.4717894	9.8798756	1
60	297043	7580781	8.4728189	9.8797140	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

76 DEGREES.

14 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	297043	7580781	8.4728189	9.8797140	60
1	297747	7577959	8.4738472	9.8795522	59
2	298452	7575137	8.4748742	9.8793905	58
3	299158	7572315	8.4759001	9.8792286	57
4	299865	7569493	8.4769246	9.8790668	56
5	300572	7566671	8.4779480	9.8789048	55
6	301280	7563850	8.4789701	9.8787429	54
7	301989	7561029	8.4799910	9.8785809	53
8	302699	7558208	8.4810107	9.8784188	52
9	303410	7555387	8.4820291	9.8782567	51
10	304121	7552566	8.4830464	9.8780946	50
11	304833	7549746	8.4840625	9.8779323	49
12	305546	7546926	8.4850773	9.8777701	48
13	306260	7544106	8.4860910	9.8776078	47
14	306975	7541286	8.4871034	9.8774454	46
15	307691	7538467	8.4881146	9.8772850	45
16	308407	7535648	8.4891247	9.8771206	44
17	309124	7532829	8.4901336	9.8769581	43
18	309842	7530010	8.4911412	9.8767955	42
19	310561	7527191	8.4921477	9.8766329	41
20	311281	7524372	8.4931530	9.8764703	40
21	312002	7521554	8.4941572	9.8763076	39
22	312723	7518736	8.4951601	9.8761449	38
23	313445	7515918	8.4961619	9.8759821	37
24	314168	7513100	8.4971625	9.8758192	36
25	314892	7510283	8.4981619	9.8756563	35
26	315617	7507466	8.4991602	9.8754934	34
27	316343	7504649	8.5001573	9.8753304	33
28	317069	7501832	8.5011532	9.8751674	32
29	317796	7499016	8.5021480	9.8750043	31
30	318524	7496200	8.5031416	9.8748412	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

75 DEGREES.

14 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	318524	7496200	8.5031416	9.8748412	30
31	319253	7493384	8.5041341	9.8746780	29
32	319983	7490568	8.5051254	9.8745147	28
33	320713	7487752	8.5061136	9.8743514	27
34	321444	7484936	8.5071046	9.8741881	26
35	322176	7482121	8.5080925	9.8740247	25
36	322909	7479306	8.5090792	9.8738613	24
37	323643	7476491	8.5100648	9.8736978	23
38	324377	7473676	8.5110493	9.8735343	22
39	325112	7470862	8.5120326	9.8733707	21
40	325848	7468048	8.5130148	9.8732071	20
41	326585	7465234	8.5139959	9.8730434	19
42	327323	7462420	8.5149758	9.8728797	18
43	328062	7459607	8.5159546	9.8727159	17
44	328801	7456794	8.5169324	9.8725521	16
45	329541	7453981	8.5179089	9.8723882	15
46	330282	7451168	8.5188844	9.8722243	14
47	331024	7448355	8.5198588	9.8720603	13
48	331767	7445542	8.5208320	9.8718963	12
49	332510	7442730	8.5218042	9.8717322	11
50	333254	7439918	8.5227752	9.8715682	10
51	333999	7437106	8.5237451	9.8714040	9
52	334745	7434294	8.5247140	9.8712398	8
53	335492	7431483	8.5256817	9.8710755	7
54	336239	7428672	8.5266484	9.8709112	6
55	336987	7425861	8.5276139	9.8707468	5
56	337736	7423050	8.5285784	9.8705824	4
57	338486	7420240	8.5295417	9.8704179	3
58	339237	7417430	8.5305040	9.8702534	2
59	339989	7414620	8.5314652	9.8700888	1
60	340742	7411810	8.5324253	9.8699243	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

75 DEGREES.

15 DEGREES.

M.	Natural Verſed Sine.	Natural Co-Verſed Sine.	Logarithm Verſed Sine.	Logarithm Co-Verſed Sine.	
0	340742	7411810	8.5324253	9.8699243	60
1	341495	7409000	8.5333844	9.8697596	59
2	342249	7406191	8.5343423	9.8695949	58
3	343004	7403382	8.5352992	9.8694301	57
4	343760	7400573	8.5362551	9.8692653	56
5	344516	7397764	8.5372098	9.8691004	55
6	345273	7394955	8.5381635	9.8689355	54
7	346031	7392147	8.5391161	9.8687705	53
8	346790	7389339	8.5400677	9.8686056	52
9	347550	7386531	8.5410182	9.8684405	51
10	348311	7383723	8.5419676	9.8682754	50
11	349073	7380916	8.5429160	9.8681102	49
12	349835	7378109	8.5438633	9.8679450	48
13	350598	7375302	8.5448096	9.8677797	47
14	351362	7372495	8.5457548	9.8676145	46
15	352127	7369688	8.5466983	9.8674491	45
16	352892	7366882	8.5476422	9.8672837	44
17	353658	7364076	8.5485843	9.8671182	43
18	354425	7361270	8.5495253	9.8669527	42
19	355193	7358464	8.5504654	9.8667871	41
20	355962	7355658	8.5514044	9.8666216	40
21	356732	7352853	8.5523423	9.8664559	39
22	357502	7350048	8.5532793	9.8662902	38
23	358273	7347243	8.5542152	9.8661244	37
24	359045	7344438	8.5551500	9.8659586	36
25	359818	7341634	8.5560839	9.8657927	35
26	360592	7338830	8.5570167	9.8656269	34
27	361367	7336026	8.5579485	9.8654609	33
28	362142	7333223	8.5588793	9.8652949	32
29	362918	7330420	8.5598091	9.8651288	31
30	363695	7327617	8.5607379	9.8649627	30
	Natural Co-Verſed Sine.	Natural VerſedSine.	LogarithmCo-Verſed Sine.	Logarithm Verſed Sine.	M.

74 DEGREES.

15 DEGREES.

M.	Natural Verſed Sine.	Natural Co-Verſed Sine.	Logarithm Verſed Sine.	Logarithm Co Verſed Sine.	
30	363695	7327617	8.5607379	9.8649627	30
31	364473	7324814	8.5616656	9.8647965	29
32	365252	7322011	8.5625924	9.8646303	28
33	366031	7319208	8.5635181	9.8644641	27
34	366311	7316405	8.5644429	9.8642978	26
35	367592	7313603	8.5653666	9.8641314	25
36	368374	7310801	8.5662894	9.8639650	24
37	369157	7307999	8.5672111	9.8637985	23
38	369941	7305198	8.5681318	9.8636320	22
39	370725	7302397	8.5690516	9.8634655	21
40	371510	7299596	8.5699704	9.8632989	20
41	372296	7296795	8.5708881	9.8631322	19
42	373083	7293995	8.5718049	9.8629655	18
43	373871	7291195	8.5727207	9.8627987	17
44	374659	7288395	8.5736355	9.8626319	16
45	375448	7285595	8.5745494	9.8624650	15
46	376238	7282796	8.5754622	9.8622981	14
47	377029	7279997	8.5763741	9.8621314	13
48	377821	7277198	8.5762850	9.8619642	12
49	378613	7274399	8.5781949	9.8617971	11
50	379406	7271600	8.5791039	9.8616300	10
51	380200	7268802	8.5800119	9.8614628	9
52	380995	7266004	8.5809189	9.8612956	8
53	381791	7263206	8.5818250	9.8611283	7
54	382587	7260408	8.5827301	9.8609610	6
55	383384	7257611	8.5836342	9.8607936	5
56	384182	7254814	8.5845374	9.8606262	4
57	384981	7252017	8.5854396	9.8604587	3
58	385781	7249220	8.5863409	9.8602912	2
59	386582	7246423	8.5872412	9.8601236	1
60	387383	7243627	8.5881406	9.8599560	0
	Natural Co-Verſed Sine.	Natural Verſed Sine.	Logarithm Co Verſed Sine.	Logarithm Verſed Sine.	M.

74 DEGREES.

16 DEGREES.					
M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	387383	7243627	8.5881406	9.8599560	60
1	388185	7240831	8.5890390	9.8597883	59
2	388988	7238035	8.5899365	9.8596206	58
3	389792	7235239	8.5908330	9.8594529	57
4	390597	7232444	8.5917286	9.8592851	56
5	391402	7229649	8.5926232	9.8591171	55
6	392208	7226854	8.5935170	9.8589492	54
7	393015	7224059	8.5944097	9.8587812	53
8	393823	7221265	8.5953016	9.8586132	52
9	394632	7218471	8.5961925	9.8584451	51
10	395441	7215677	8.5970824	9.8582770	50
11	296251	7212883	8.5979715	9.8581088	49
12	297062	7210089	8.5988596	9.8579406	48
13	297874	7207296	8.5997468	9.8577723	47
14	298687	7204503	8.6006330	9.8576040	46
15	299501	7201710	8.6015184	9.8574356	45
16	400315	7198918	8.6024028	9.8572672	44
17	401130	7196126	8.6032863	9.8570987	43
18	401946	7193334	8.6041689	9.8569302	42
19	402763	7190542	8.6050505	9.8567615	41
20	403581	7187750	8.6059313	9.8565929	40
21	404400	7184959	8.6068112	9.8564242	39
22	405219	7182168	8.6076901	9.8562555	38
23	406039	7179377	8.6085681	9.8560867	37
24	406860	7176586	8.6094453	9.8559179	36
25	407682	7173796	8.6103215	9.8557489	35
26	408505	7171006	8.6111968	9.8555800	34
27	409328	7168216	8.6120712	9.8554110	33
28	410152	7165426	8.6129448	9.8552420	32
29	410977	7162636	8.6138174	9.8550728	31
30	411803	7159847	8.6146891	9.8549037	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine	M.
73 DEGREES.					

16 DEGREES.					
M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	411803	7159847	8.6146891	9.8549037	30
31	412629	7157058	8.6155600	9.8547345	29
32	413456	7154269	8.6164299	9.8545653	28
33	414284	7151480	8.6172990	9.8543959	27
34	415113	7148692	8.6181672	9.8542266	26
35	415947	7145904	8.6190345	9.8540572	25
36	416774	7143116	8.6199009	9.8538877	24
37	417605	7140328	8.6207664	9.8537182	23
38	418437	7137541	8.6216331	9.8535486	22
39	419270	7134754	8.6224948	9.8533790	21
40	420104	7131967	8.6233577	9.8532094	20
41	420939	7129181	8.6242197	9.8530396	19
42	421775	7126395	8.6250809	9.8528699	18
43	422611	7123609	8.6259412	9.8527000	17
44	423448	7120823	8.6268006	9.8525302	16
45	424286	7118037	8.6271951	9.8523602	15
46	425125	7115252	8.6285168	9.8521903	14
47	425964	7112467	8.6293736	9.8520202	13
48	426804	7109682	8.6302295	9.8518502	12
49	427645	7106897	8.6310846	9.8516800	11
50	428487	7104112	8.6319388	9.8515099	10
51	429330	7101328	8.6327922	9.8513396	9
52	430174	7098544	8.6336447	9.8511693	8
53	431018	7095760	8.6344964	9.8509990	7
54	431863	7092977	8.6353472	9.8508286	6
55	432709	7090194	8.6361971	9.8506581	5
56	433556	7087411	8.6370462	9.8504877	4
57	434404	7084629	8.6378945	9.8503171	3
58	435253	7081847	8.6387419	9.8501465	2
59	436102	7079065	8.6395884	9.8499759	1
60	436952	7076283	8.6404342	9.8498052	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.
73 DEGREES.					

17 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	436952	7076283	8.6404342	9.8498052	60
1	437803	7073501	8.6412790	9.8496344	59
2	438655	7070720	8.6421231	9.8494636	58
3	439508	7067939	8.6429663	9.8492928	57
4	440361	7065158	8.6438087	9.8491219	56
5	441215	7062377	8.6446502	9.8489509	55
6	442070	7059597	8.6454909	9.8487799	54
7	442926	7056817	8.6463308	9.8486088	53
8	443782	7054037	8.6471698	9.8484377	52
9	444639	7051257	8.6479880	9.8482665	51
10	445498	7048477	8.6488454	9.8480953	50
11	446357	7045698	8.6496820	9.8479240	49
12	447216	7042919	8.6505177	9.8477527	48
13	448077	7040140	8.6513526	9.8475813	47
14	448938	7037362	8.6521867	9.8474099	46
15	449801	7034584	8.6530200	9.8472384	45
16	450664	7031806	8.6538524	9.8470669	44
17	451527	7029028	8.6546841	9.8468953	43
18	452392	7026250	8.6555149	9.8467237	42
19	453257	7023473	8.6563449	9.8465520	41
20	454124	7020696	8.6571741	9.8463802	40
21	454991	7017919	8.6580025	9.8462084	39
22	455859	7015143	8.6588301	9.8460366	38
23	456727	7012367	8.6596569	9.8458647	37
24	457597	7009591	8.6604829	9.8456927	36
25	458467	7006815	8.6613081	9.8455207	35
26	459338	7004040	8.6621324	9.8453487	34
27	460210	7001265	8.6629560	9.8451765	33
28	461083	6998490	8.6637788	9.8450044	32
29	461956	6995716	8.6646008	9.8448322	31
30	462830	6992942	8.6654220	9.8446599	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

72 DEGREES.

17 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	462830	6992942	8.6654210	9.8446599	30
31	463706	6990168	8.6662424	9.8444876	29
32	464582	6987394	8.6670620	9.8443152	28
33	465458	6984620	8.6678808	9.8441428	27
34	466336	6981847	8.6686988	9.8439703	26
35	467214	6979074	8.6695160	9.8437978	25
36	468093	6976301	8.6703324	9.8436252	24
37	468973	6973528	8.6711481	9.8434526	23
38	469854	6970756	8.6719630	9.8432799	22
39	470736	6967984	8.6727771	9.8431071	21
40	471618	6965212	8.6735904	9.8429344	20
41	472501	6962441	8.6744029	9.8427615	19
42	473385	6959670	8.6752147	9.8425886	18
43	474270	6956899	8.6760256	9.8424156	17
44	475156	6954128	8.6768358	9.8422427	16
45	476042	6951357	8.6776453	9.8420696	15
46	476929	6948587	8.6784539	9.8418965	14
47	477817	6945817	8.6792618	9.8417233	13
48	478706	6943047	8.6800689	9.8415501	12
49	479596	6940277	8.6808753	9.8413768	11
50	480486	6937508	8.6816809	9.8412035	10
51	481377	6934739	8.6824857	9.8410301	9
52	482269	6931970	8.6832897	9.8408567	8
53	483162	6929202	8.6840930	9.8406832	7
54	484056	6926434	8.6848956	9.8405097	6
55	484950	6623666	8.6856973	9.8403361	5
56	485846	6920898	8.6864984	9.8401625	4
57	486742	6918131	8.6872986	9.8399887	3
58	487639	6915364	8.6880981	9.8398150	2
59	488536	6912597	8.6888969	9.8396412	1
60	489435	6909830	8.6896949	9.8394674	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

72 DEGREES.

18 DEGREES.

M.	Natural Verfed Sine.	Natural Co-Verfed Sine.	Logarithm Verfed Sine.	Logarithm Co-Verfed Sine.	
0	489435	6909830	8.6896949	9.8394674	60
1	490334	6907064	8.6904921	9.8392934	59
2	491234	6904298	8.6912886	9.8391195	58
3	492135	6901532	8.6920844	9.8389455	57
4	493037	6898766	8.6928794	9.8387714	56
5	493939	6896001	8.6936736	9.8385973	55
6	494843	6893236	8.6944672	9.8384233	54
7	495747	6890471	8.6952599	9.8382489	53
8	496652	6887706	8.6960520	9.8380746	52
9	497557	6884942	8.6968432	9.8379003	51
10	498464	6882178	8.6976338	9.8377259	50
11	499371	6879414	8.6984236	9.8375514	49
12	500279	6876651	8.6992127	9.8373770	48
13	501188	6873888	8.7000010	9.8372024	47
14	502098	6871125	8.7007886	9.8370278	46
15	503009	6868362	8.7015755	9.8368531	45
16	503920	6865600	8.7023617	9.8366785	44
17	504832	6862838	8.7031471	9.8365037	43
18	505745	6860076	8.7039318	9.8363289	42
19	506659	6857314	8.7047158	9.8361540	41
20	507574	6854552	8.7054990	9.8359791	40
21	508489	6851791	8.7062815	9.8358041	39
22	509405	6849030	8.7070633	9.8356291	38
23	510322	6846269	8.7078444	9.8354540	37
24	511240	6843509	8.7086247	9.8352789	36
25	512158	6840749	8.7094044	9.8351037	35
26	513078	6837989	8.7101833	9.8349285	34
27	513998	6835230	8.7109615	9.8347531	33
28	514919	6832471	8.7117390	9.8345778	32
29	515841	6829712	8.7125157	9.8344024	31
30	516763	6826953	8.7132918	9.8342269	30
	Natural Co-Verfed Sine.	Natural Verfed Sine.	Logarithm Co-Verfed Sine.	Logarithm Verfed Sine.	M.

71 DEGREES.

18 DEGREES.

M.	Natural Verfed Sine.	Natural Co-Verfed Sine.	Logarithm Verfed Sine.	Logarithm Co-Verfed Sine.	
30	516763	6826953	8.7132918	9.8342269	30
31	517687	6824195	8.7140671	9.8340514	29
32	518611	6821437	8.7148418	9.8338759	28
33	519536	6818679	8.7156157	9.8337002	27
34	520462	6815921	8.7163889	9.8335246	26
35	521388	6813103	8.7171614	9.8333488	25
36	522316	6810406	8.7179332	9.8331731	24
37	523244	6807649	8.7187044	9.8329972	23
38	524173	6804892	8.7194748	9.8328213	22
39	525103	6802136	8.7202445	9.8326454	21
40	526034	6799380	8.7210135	9.8324694	20
41	526965	6796625	8.7217818	9.8322933	19
42	527897	6793870	8.7225494	9.8321172	18
43	528830	6791115	8.7233163	9.8319411	17
44	529764	6788360	8.7240825	9.8317649	16
45	530699	6785605	8.7248480	9.8315886	15
46	531634	6782850	8.7256129	9.8314123	14
47	532570	6780096	8.7263770	9.8312359	13
48	533507	6777342	8.7271404	9.8310595	12
49	534445	6774588	8.7279032	9.8308830	11
50	535384	6771835	8.7286653	9.8307064	10
51	536323	6769082	8.7294267	9.8305298	9
52	537264	6766329	8.7301874	9.8303532	8
53	538205	6763577	8.7309474	9.8301765	7
54	539146	6760825	8.7317067	9.8299997	6
55	540089	6758073	8.7324654	9.8298229	5
56	541032	6755321	8.7332233	9.8296401	4
57	541977	6752570	8.7339806	9.8294691	3
58	542922	6749819	8.7347373	9.8292922	2
59	543868	6747068	8.7354932	9.8291151	1
60	544814	6744318	8.7362485	9.8289381	0
	Natural Co-Verfed Sine.	Natural Verfed Sine.	Logarithm Co-Verfed Sine.	Logarithm Verfed Sine.	M.

71 DEGREES.

19 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	544810	6744318	8.7362485	9.8289381	60
1	545762	6741568	8.7370030	9.8287609	59
2	546710	6738818	8.7377570	9.8285837	58
3	547659	6736069	8.7385102	9.8284065	57
4	548609	6733319	8.7392628	9.8282292	56
5	549559	6730570	8.7400147	9.8280518	55
6	550511	6727821	8.7407659	9.8278744	54
7	551463	6725073	8.7415165	9.8276969	53
8	552416	6722325	8.7422664	9.8275194	52
9	553370	6719577	8.7430156	9.8273418	51
10	554325	6716829	8.7437642	9.8271642	50
11	555280	6714082	8.7445121	9.8269865	49
12	556236	6711335	8.7452593	9.8268088	48
13	557193	6708588	8.7460059	9.8266310	47
14	558151	6705841	8.7467518	9.8264532	46
15	559110	6703094	8.7474971	9.8262753	45
16	560069	6700348	8.7482417	9.8260973	44
17	561029	6697602	8.7489857	9.8259193	43
18	561990	6694856	8.7497290	9.8257412	42
19	562952	6692111	8.7504716	9.8255631	41
20	563915	6689366	8.7512136	9.8253849	40
21	564878	6686621	8.7519549	9.8252067	39
22	565843	6683877	8.7526956	9.8250284	38
23	566808	6681133	8.7534357	9.8248501	37
24	567773	6678389	8.7541751	9.8246717	36
25	568740	6675645	8.7549138	9.8244932	35
26	569707	6672902	8.7556519	9.8243147	34
27	570676	6670159	8.7563894	9.8241361	33
28	571645	6667415	8.7571262	9.8239576	32
29	572614	6664673	8.7578623	9.8237785	31
30	573585	6661931	8.7585979	9.8236002	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

70 DEGREES.

19 DEGREES.

M.	Nautral Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	573585	6661931	8.7585979	9.8236002	30
31	574556	6659189	8.7593327	9.8234213	29
32	575529	6656447	8.7600670	9.8232425	28
33	576502	6653706	8.7608006	9.8230636	27
34	577475	6650965	8.7615336	9.8228847	26
35	578450	6648224	8.7622659	9.8227057	25
36	579425	6645484	8.7629976	9.8225266	24
37	580402	6642744	8.7637286	9.8223475	23
38	581379	6640004	8.7644591	9.8221684	22
39	582356	6637264	8.7651889	9.8219891	21
40	583335	6634525	8.7659180	9.8218099	20
41	584314	6631786	8.7666466	9.8216305	19
42	585295	6629047	8.7673745	9.8214511	18
43	586276	6626309	8.7681018	9.8212717	17
44	587257	6623571	8.7688284	9.8210922	16
45	588240	6620833	8.7695544	9.8209126	15
46	589223	6618095	8.7702798	9.8207330	14
47	590207	6615358	8.7710046	9.8205533	13
48	591192	6612621	8.7717288	9.8203736	12
49	592178	6609884	8.7724523	9.8201938	11
50	593164	6607148	8.7731752	9.8200140	10
51	594152	6604412	8.7738975	9.8198341	9
52	595140	6601676	8.7746192	9.8196542	8
53	596129	6598940	8.7753402	9.8194741	7
54	597119	6596205	8.7760607	9.8192941	6
55	598109	6593470	8.7767805	9.8191140	5
56	599101	6590735	8.7774997	9.8189338	4
57	600093	6588001	8.7782183	9.8187536	3
58	601086	6585267	8.7789363	9.8185733	2
59	602079	6582533	8.7796537	9.8183930	1
60	603074	6579799	8.7803705	9.8182126	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

70 DEGREES.

20 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	603074	6579799	8.7803705	9.8182126	60
1	604069	6577066	8.7810863	9.8180321	59
2	605065	6574333	8.7818022	9.8178516	58
3	606062	6571600	8.7825168	9.8176711	57
4	607060	6568867	8.7832314	9.8174905	56
5	608058	6566135	8.7839499	9.8173098	55
6	609057	6563403	8.7846583	9.8171291	54
7	610058	6560671	8.7853705	9.8169483	53
8	611059	6557940	8.7860827	9.8167675	52
9	612060	6555209	8.7867937	9.8165865	51
10	613062	6552478	8.7875047	9.8164056	50
11	614066	6549747	8.7882146	9.8162246	49
12	615070	6547017	8.7889244	9.8160435	48
13	616075	6544287	8.7896330	9.8158624	47
14	617080	6541558	8.7903416	9.8156812	46
15	618087	6538829	8.7910491	9.8155000	45
16	619094	6536100	8.7917565	9.8153187	44
17	620102	6533371	8.7924627	9.8151373	43
18	621111	6530643	8.7931690	9.8149560	42
19	622120	6527915	8.7938740	9.8147745	41
20	623131	6525187	8.7945791	9.8145930	40
21	624142	6522460	8.7952830	9.8144114	39
22	625154	6519733	8.7959869	9.8142298	38
23	626167	6517006	8.7966896	9.8140481	37
24	627180	6514279	8.7973923	9.8138664	36
25	628194	6511553	8.7980938	9.8136846	35
26	629210	6509027	8.7987953	9.8135027	34
27	630226	6506101	8.7994957	9.8133208	33
28	631242	6503376	8.8001961	9.8131389	32
29	632260	6500651	8.8008953	9.8129568	31
30	633278	6497925	8.8015945	9.8127748	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

69 DEGREES.

20 DEGREES.

M.	Nautral Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	633278	6497925	8.8015945	9.8127748	30
31	634297	6495201	8.8022925	9.8125926	29
32	635317	6492477	8.8029906	9.8124104	28
33	636338	6489753	8.8036874	9.8122282	27
34	637359	6487029	8.8043843	9.8120459	26
35	638382	6484306	8.8050801	9.8118635	25
36	639405	6481583	8.8057758	9.8116811	24
37	640429	6478860	8.8064704	9.8114986	23
38	641453	6476138	8.8071649	9.8113161	22
39	642479	6473416	8.8078584	9.8111335	21
40	643505	6470694	8.8085518	9.8109509	20
41	644532	6467973	8.8092441	9.8107682	19
42	645560	6465252	8.8099364	9.8105854	18
43	646588	6462531	8.8106276	9.8104026	17
44	647618	6459810	8.8113187	9.8102197	16
45	648648	6457090	8.8120087	9.8100368	15
46	649679	6454370	8.8126988	9.8098538	14
47	650711	6451650	8.8133876	9.8096708	13
48	651743	6448930	8.8140765	9.8094877	12
49	652777	6446211	8.8147643	9.8093045	11
50	653811	6443492	8.8154521	9.8091213	10
51	654846	6440773	8.8161387	9.8089380	9
52	655881	6438055	8.8168253	9.8087547	8
53	656918	6435337	8.8175108	9.8085713	7
54	657955	6432620	8.8181964	9.8083879	6
55	658993	6429903	8.8188808	9.8082044	5
56	660032	6427186	8.8195652	9.8080208	4
57	661072	6424469	8.8202484	9.8078372	3
58	662112	6421753	8.8209317	9.8076536	2
59	663154	6419037	8.8216139	9.8074698	1
60	664196	6416321	8.8222901	9.8072860	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

69 DEGREES.

21 DEGREES.

M.	Natural Verſed Sine.	Natural Co-Verſed Sine.	Logarithm Verſed Sine.	Logarithm Co-Verſed Sine.	
0	664196	6416321	8.8222961	9.8072860	60
1	665239	6413605	8.8229772	9.8071022	59
2	666282	6410890	8.8236582	9.8069183	58
3	667327	6408175	8.8243382	9.8067343	57
4	668372	6405460	8.8250182	9.8065503	56
5	669418	6402746	8.8256970	9.8063662	55
6	670465	6400032	8.8263759	9.8061821	54
7	671512	6397318	8.8270537	9.8059979	53
8	672561	6394605	8.8277314	9.8058137	52
9	673610	6391892	8.8284081	9.8056294	51
10	674660	6389179	8.8290848	9.8054451	50
11	675710	6386467	8.8297604	9.8052606	49
12	676762	6383755	8.8304360	9.8050762	48
13	677814	6381043	8.8311105	9.8048916	47
14	678867	6378331	8.8317850	9.8047070	46
15	679921	6375620	8.8324584	9.8045224	45
16	680976	6372909	8.8331318	9.8043377	44
17	682031	6370198	8.8338041	9.8041529	43
18	683088	6367488	8.8344765	9.8039681	42
19	684145	6364778	8.8351477	9.8037832	41
20	685203	6362068	8.8358190	9.8035983	40
21	686261	6359358	8.8364892	9.8034133	39
22	687321	6356649	8.8371594	9.8032283	38
23	688381	6353940	8.8378285	9.8020431	37
24	689442	6351232	8.8384976	9.8028580	36
25	690504	6348524	8.8391657	9.8026727	35
26	691566	6345816	8.8398337	9.8024875	34
27	692630	6343108	8.8405007	9.8023021	33
28	693694	6340401	8.8411677	9.8021167	32
29	694759	6337698	8.8418337	9.8019313	31
30	695824	6334988	8.8424996	9.8017458	30
	Natural Co-Verſed Sine.	Natural Verſed Sine.	Logarithm Co-Verſed Sine.	Logarithm Verſed Sine.	M.

68 DEGREES.

21 DEGREES.

M.	Natural Verſed Sine.	Natural Co-Verſed Sine.	Logarithm Verſed Sine.	Logarithm Co-Verſed Sine.	
30	695824	6334988	8.8424996	9.8017458	30
31	696891	6332282	8.8431645	9.8015602	29
32	697958	6329576	8.8438294	9.8003746	28
33	699026	6326870	8.8444932	9.8001889	27
34	700095	6324165	8.8451570	9.8000031	26
35	701165	6321459	8.84581[illegible]8	9.8008173	25
36	702235	6318754	8.8464826	9.8006315	24
37	703306	6316049	8.8471443	9.8004455	23
38	704378	6313345	8.8478060	9.8002596	22
39	705451	6310641	8.8484667	9.8000735	21
40	706525	6307938	8.8491274	9.7998875	20
41	707599	6305235	8.8497870	9.7997013	19
42	708674	6302532	8.8504467	9.7995151	18
43	709750	6299830	8.8511053	9.7993288	17
44	710827	6297128	8.8517639	9.7991425	16
45	711904	6294426	8.8524215	9.7989561	15
46	712983	6291724	8.8530790	9.7987697	14
47	714062	6289023	8.8537356	9.7985831	13
48	715142	6286322	8.8543921	9.7983966	12
49	716222	6283621	8.8550476	9.7982099	11
50	717304	6280920	8.8557032	9.7980233	10
51	718386	6278220	8.8563576	9.7978365	9
52	719469	6275520	8.8570121	9.7976498	8
53	720553	6272820	8.8576656	9.7974629	7
54	721637	6270122	8.8583191	9.7972760	6
55	722723	6267423	8.8589715	9.7970890	5
56	723809	6264725	8.8596240	9.7969020	4
57	724896	6262027	8.8602754	9.7967149	3
58	725984	6259329	8.8609268	9.7965278	2
59	727072	6256631	8.8615773	9.7963405	1
60	728161	6253934	8.8622277	9.7961534	0
	Natural Co-Verſed Sine.	Natural Verſed Sine.	Logarithm Co-Verſed Sine.	Logarithm Verſed Sine.	M.

68 DEGREES.

22 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	728161	6253934	8.86222 77	9.7961533	60
1	729251	6251237	8.8628771	9.7959659	59
2	730342	6248540	8.8633265	9.7957786	58
3	731434	6245844	8.8641749	9.7955911	57
4	732526	6243148	8.8648233	9.7954037	56
5	733619	6240452	8.8654707	9.7952161	55
6	734713	6237757	8.8661181	9.7950285	54
7	735808	6235062	8.8667645	9.7948408	53
8	736904	6232367	8.8674109	9.7946531	52
9	738000	6229673	8.8680563	9.7944652	51
10	739097	6226979	8.8687018	9.7942774	50
11	740195	6224285	8.8693462	9.7940895	49
12	741294	6221592	8.8699906	9.7939015	48
13	742394	6218899	8.8706340	9.7937135	47
14	743494	6216206	8.8712774	9.7935254	46
15	744595	6213514	8.8719198	9.7933372	45
16	745697	6210822	8.8725623	9.7931491	44
17	746800	6208130	8.8732037	9.7929608	43
18	747903	6205438	8.8738452	9.7927725	42
19	749007	6202747	8.8744856	9.7925841	41
20	750112	6200056	8.8751261	9.7923956	40
21	751218	6197365	8.8757656	9.7922071	39
22	752324	6194675	8.8764051	9.7920187	38
23	753431	6191985	8.8770436	9.7918299	37
24	754539	6189296	8.8776821	9.7916413	36
25	755648	6186607	8.8783196	9.7914525	35
26	756758	6183918	8.8789571	9.7912637	34
27	757869	6181229	8.8795937	9.7910748	33
28	758980	6178541	8.8802303	9.7908859	32
29	760092	6175853	8.8808659	9.7906969	31
30	761205	6173166	8.8815014	9.7905079	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm-Versed Sine.	M.

67 DEGREES.

22 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	761205	6173166	8.8815014	9.7905079	30
31	762318	6170479	8.8821361	9.7903188	29
32	763432	6167792	8.8827707	9.7901297	28
33	764547	6165105	8.8834044	9.7899404	27
34	765663	6162419	8.8840380	9.7897512	26
35	766780	6159733	8.8846707	9.7895618	25
36	767897	6157047	8.8853034	9.7893725	24
37	769015	6154362	8.8859352	9.7891830	23
38	770134	6151677	8.8865669	9.7889935	22
39	771254	6148992	8.8871977	9.7888039	21
40	772375	6146308	8.8878285	9.7886143	20
41	773496	6143624	8.8884584	9.7884245	19
42	774618	6140940	8.8890882	9.7882348	18
43	775741	6138257	8.8897171	9.7880450	17
44	776865	6135574	8.8903460	9.7878551	16
45	777990	6132891	8.8909739	9.7876652	15
46	779116	6130209	8.8916019	9.7874752	14
47	780242	6127527	8.8922289	9.7872851	13
48	781369	6124845	8.8928559	9.7870950	12
49	782496	6122163	8.8934820	9.7869048	11
50	783624	6119482	8.8941080	9.7867146	10
51	784753	6116801	8.8947331	9.7865242	9
52	785883	6114120	8.8953583	9.7863340	8
53	787014	6111440	8.8959825	9.7861435	7
54	788145	6108760	8.8966066	9.7859531	6
55	789277	6106081	8.8972299	9.7857625	5
56	790410	6103402	8.8978532	9.7855720	4
57	791544	6100723	8.8984755	9.7853813	3
58	792679	6098045	8.8990978	9.7851906	2
59	793815	6095367	8.8997192	9.7849998	1
60	794951	6092689	8.9003406	9.7848090	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

67 DEGREES.

23 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	794951	6092689	8.9003406	9.7848090	60
1	796088	6090011	8.9009611	9.7846181	59
2	797226	6087334	8.9015816	9.7844271	58
3	798365	6084657	8.9022011	9.7842361	57
4	799504	6081980	8.9020207	9.7840450	56
5	800644	6079304	8.9034393	9.7838539	55
6	801785	6076628	8.9040579	9.7836627	54
7	802927	6073952	8.9046757	9.7834714	53
8	804069	6071277	8.9052934	9.7832801	52
9	805212	6068602	8.9059102	9.7830887	51
10	806356	6065928	8.9065270	9.7828973	50
11	807501	6063254	8.9071429	9.7827058	49
12	808647	6060580	8.9077588	9.7825143	48
13	809793	6057907	8.9083738	9.7823226	47
14	810940	6055234	8.9089887	9.7821309	46
15	812088	6052561	8.9096028	9.7819392	45
16	813237	6049888	8.9102169	9.7817474	44
17	814386	6047216	8.9108301	9.7815555	43
18	815536	6044544	8.9114432	9.7813636	42
19	816687	6041872	8.9120555	9.7811716	41
20	817839	6039201	8.9126678	9.7809796	40
21	818991	6036530	8.9132792	9.7807874	39
22	820145	6033860	8.9138905	9.7805953	38
23	821299	6031190	8.9145010	9.7804030	37
24	822454	6028520	8.9151115	9.7802108	36
25	823609	6025851	8.9157211	9.7800184	35
26	824766	6023182	8.9163306	9.7798260	34
27	825923	6020513	8.9169393	9.7796335	33
28	827081	6017845	8.9175480	9.7794410	32
29	828240	6015177	8.9181558	9.7792484	31
30	829399	6012509	8.9187636	9.7790558	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm-Versed Sine.	M.

66 DEGREES.

23 DEGREES.

M	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	829399	6012509	8.9187636	9.7790558	30
31	830560	6009841	8.9193706	9.7788630	29
32	831721	6007174	8.9199775	9.7786703	28
33	832882	6004507	8.9205835	9.7784774	27
34	834045	6001841	8.9211895	9.7782845	26
35	835209	5999175	8.9217947	9.7780915	25
36	836373	5996509	8.9223999	9.7778985	24
37	837538	5993844	8.9230041	9.7777054	23
38	838703	5991179	8.9236084	9.7775123	22
39	839870	5988514	8.9242118	9.7773191	21
40	841037	5985850	8.9248152	9.7771258	20
41	842205	5983186	8.9254177	9.7769325	19
42	843374	5980522	8.9260202	9.7767391	18
43	844544	5977859	8.9266219	9.7765456	17
44	845714	5975196	8.9272235	9.7763521	16
45	846885	5972533	8.9278243	9.7761585	15
46	848057	5969870	8.9284251	9.7759649	14
47	849230	5967208	8.9290250	9.7757712	13
48	850403	5964546	8.9296249	9.7755775	12
49	851578	5961885	8.9302240	9.7753836	11
50	852753	5959224	8.9308231	9.7751898	10
51	853928	5956563	8.9314212	9.7749958	9
52	855105	5953903	8.9320194	9.7748018	8
53	856282	5951243	8.9326168	9.7746077	7
54	857460	5948584	8.9332141	9.7744136	6
55	858639	5945925	8.9338106	9.7742194	5
56	859819	5943266	8.9344070	9.7740252	4
57	860999	5940608	8.9350027	9.7738308	3
58	862181	5937950	8.9355983	9.7736365	2
59	863363	5935292	8.9361930	9.7734420	1
60	864545	5932634	8.9367878	9.7732475	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

66 DEGREES.

24 DEGREES.					
M.	Natutral Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	864545	5932634	8.9367878	9.7732475	60
1	865729	5929977	8.9373817	9.7730529	59
2	866913	5927320	8.9379756	9.7728583	58
3	868098	5924663	8.9385687	9.7726636	57
4	869284	5922007	8.9391618	9.7724689	56
5	870471	5919351	8.9397540	9.7722741	55
6	871658	5916695	8.9403462	9.7720792	54
7	872846	5914040	8.9409376	9.7718842	53
8	874035	5911385	8.9415290	9.7716893	52
9	875225	5908731	8.9421195	9.7714942	51
10	876416	5906077	8.9427101	9.7712[illegible]1	50
11	877607	5903423	8.9432998	9.7711039	49
12	878799	5900769	8.9438895	9.7709087	48
13	879992	5898116	8.9444783	9.7707133	47
14	881185	5895463	8.9450672	9.7705180	46
15	882380	5892811	8.9456552	9.7703225	45
16	883575	5890159	8.9462433	9.7701271	44
17	884771	5887507	8.9468305	9.7699315	43
18	885967	5884856	8.9474177	9.7697359	42
19	887165	5882205	8.9480040	9.7695402	41
20	888363	5879554	8.9485904	9.7693444	40
21	889562	5876904	8.9491759	9.7691486	39
22	890762	5874254	8.9497615	9.7689528	38
23	891962	5871605	8.95[illegible]3462	9.7687568	37
24	893163	5868956	8.9509309	9.7685608	36
25	894365	5866307	8.9515148	9.7[illegible]68[illegible]647	35
26	895568	5863656	8.[illegible]520982	9.7681687	34
27	896771	5[illegible]6[illegible]0[illegible]	8.[illegible]526318	9.7679724	33
28	897976	58[illegible]836[illegible]	8.9532648	9.7677762	32
29	899181	585571	8.9538471	9.7675799	31
30	900387	585306[illegible]	8.9544294	9.7673835	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co Versed Sine.	Logarithm Versed Sine.	M.
65 DEGREES.					

24 DEGREES.					
M	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	900387	5853068	8.9544294	9.7673835	30
31	901594	5850421	8.9550108	9.7671871	29
32	902801	5847774	8.9555922	9.7669906	28
33	904010	5845128	8.9561729	9.7667940	27
34	905219	5842482	8.9567535	9.7665974	26
35	906428	5839837	8.9573333	9.7664007	25
36	907639	5837192	8.9579131	9.7662040	24
37	908850	5834547	8.9584921	9.7660071	23
38	910062	5831903	8.9590711	9.7658103	22
39	911275	5829259	8.9596493	9.7656133	21
40	612489	5826615	8.9602275	9.7654164	20
41	913703	5823972	8.9608049	9.7652193	19
42	914918	5821329	8.9613823	9.7650222	18
43	916134	5818687	8.9619589	9.7648249	17
44	917351	5816045	8.9625355	9.7646277	16
45	918568	5813403	8.9631112	9.7644304	15
46	919786	5810761	8.9636870	9.7642330	14
47	921005	5808120	8.9642620	9.7640355	13
48	922225	5805479	8.9648370	9.7638381	12
49	923446	5802838	8.9654122	9.7636405	11
50	924667	5800198	8.9659854	9.7634429	10
51	925889	5797558	8.9665588	9.7632451	9
52	927112	5794919	8.9671322	9.7630474	8
53	928335	5792280	8.9677048	9.7628496	7
54	929560	5789641	8.9682774	9.7626517	6
55	930785	5787003	8.9688492	9.7624537	5
56	932011	5784365	8.9694210	9.7622557	4
57	933238	5781727	8.9699900	9.7620576	3
58	934465	5779090	8.9705630	9.7618595	2
59	935693	5776453	8.9711333	9.7616613	1
60	936922	5773817	8.9717035	9.7614630	0
	Natural Co Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.
65 DEGREES.					

25 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	936922	5773817	8.9717035	9.7614630	60
1	938152	5771181	8.9722729	9.7612647	59
2	939382	5768545	8.9728424	9.7610663	58
3	940614	5765910	8.9734111	9.7608878	57
4	941846	5763275	8.9739797	9.7606693	56
5	943078	5760640	8.9745476	9.7604707	55
6	944312	5758006	8.9751155	9.7602721	54
7	945546	5755372	8.9756826	9.7600733	53
8	946781	5752738	8.9762497	9.7598746	52
9	948017	5750105	8.9768161	9.7596757	51
10	949254	5747472	8.9773824	9.7594769	50
11	950491	5744839	8.9779480	9.7592779	49
12	951729	5742207	8.9785135	9.7590789	48
13	952968	5739575	8.9790783	9.7588797	47
14	954208	5736944	8.9796431	9.7586806	46
15	955449	5734313	8.9802071	9.7584813	45
16	956690	5731682	8.9807711	9.7582821	44
17	957932	5729051	8.9813344	9.7580827	43
18	959175	5726421	8.9818976	9.7578833	42
19	960418	5723794	8.9824601	9.7576838	41
20	961662	5721162	8.9830226	9.7574843	40
21	962907	5710533	8.9835843	9.7572846	39
22	964153	5715904	8.9841460	9.7570850	38
23	965400	5713276	8.9847070	9.7568852	37
24	966647	5710648	8.9852679	9.7566854	36
25	967895	5708021	8.0858281	9.7564855	35
26	969144	5705394	8.9863883	9.7562856	34
27	970394	5702767	8.9869478	9.7560856	33
28	971644	5700141	8.9875072	9.7558856	32
29	972895	5697515	8.9880659	9.7556854	31
30	974147	5694889	8.9886246	9.7554853	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

64 DEGREES.

25 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	974147	5694889	8.9886246	9.7554853	30
31	975400	5692264	8.9891825	9.7552850	29
32	976653	5689639	8.9897404	9.7550847	28
33	977908	5687014	8.9902976	9.7548843	27
34	979162	5684390	8.9908548	9.7546839	26
35	980418	5681766	8.9914112	9.7544838	25
36	981675	5679142	8.9919676	9.7542828	24
37	982932	5676519	8.9925233	9.7540821	23
38	984190	5673896	8.9930790	9.7538814	22
39	985449	5671274	8.9936339	9.7536806	21
40	986708	5668652	8.9941888	9.7534798	20
41	987969	5666030	8.9947430	9.7532789	19
42	989230	5663409	8.9952972	9.7530779	18
43	990492	5660788	8.9958506	9.7528769	17
44	991754	5658167	8.9964041	9.7526758	16
45	993018	5655547	8.9969568	9.7524746	15
46	994282	5652927	8.9975095	9.7522734	14
47	995547	5650307	8.9980614	9.7520721	13
48	996812	5647688	8.9986134	9.7518708	12
49	998079	5645029	8.9991646	9.7516693	11
50	999346	5642451	8.9997158	9.7514679	10
51	1000614	5639833	9.0002663	9.7512663	9
52	1001883	5637215	9.0008168	9.7510647	8
53	1003152	5634598	9.0013666	9.7508630	7
54	1004422	5631981	9.0019163	9.7506613	6
55	1005694	5629365	9.0024653	9.7504594	5
56	1006965	5626749	90030144	9.7502576	4
57	1008237	5624133	90035626	9.7500556	3
58	1009511	5621518	90041109	9.7498536	2
59	1010785	5618903	90046585	9.7496515	1
60	1012060	5616288	90052061	9.7464494	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M

64 DEGREES.

26 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	1012060	5616288	9.0052061	9.7494494	60
1	1013335	5613674	9.0057529	9.7492472	59
2	1014613	5611060	9.0062997	9.7490449	58
3	1015888	5608446	9.0068458	9.7488426	57
4	1017166	5605833	9.0073920	9.7486402	56
5	1018445	5603220	9.0079344	9.7484377	55
6	1019724	5600608	9.0084827	9.7482352	54
7	1021004	5597996	9.0090274	9.7480326	53
8	1022285	5595384	9.0095721	9.7478299	52
9	1023567	5592773	9.0101160	9.7476272	51
10	1024849	5590162	9.0106600	9.7474244	50
11	1026132	5587551	9.0112032	9.7472215	49
12	1027416	5584941	9.0117465	9.7470186	48
13	1028701	5582331	9.0122890	9.7468156	47
14	1029986	5579722	9.0128315	9.7466126	46
15	1031273	5577113	9.0133733	9.7464094	45
16	1032560	5574504	9.0139154	9.7462063	44
17	1033847	5571896	9.0144562	9.7460030	43
18	1035136	5569288	9.0149973	9.7457997	42
19	1036425	5566680	9.0155377	9.7455963	41
20	1037715	5564073	9.0160781	9.7453928	40
21	1039006	5561466	9.0166177	9.7451893	39
22	1040297	5558860	9.0171574	9.7449857	38
23	1041588	5556254	9.0176964	9.7447821	37
24	1042882	5553648	9.0182353	9.7445784	36
25	1044176	5551043	9.0187736	9.7443745	35
26	1045471	5548438	9.0193119	9.7441707	34
27	1046766	5545833	9.0198494	9.7439668	33
28	1048062	5543229	9.0203870	9.7437628	32
29	1049359	5540625	9.0209238	9.7435587	31
30	1050656	5538022	9.0214607	9.7433547	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

63 DEGREES.

26 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	1050656	5538022	9.0214607	9.7433547	30
31	1051955	5535419	9.0219969	9.7431505	29
32	1053254	5532816	9.0225330	9.7429462	28
33	1054554	5530214	9.0230685	9.7427419	27
34	1055854	5527612	9.0236039	9.7425175	26
35	1057156	5525010	9.0241387	9.7423331	25
36	1058458	5522409	9.0246735	9.7421286	24
37	1059760	5519808	9.0252076	9.7419240	23
38	1061064	5517208	9.0257416	9.7417193	22
39	1062368	5514608	9.0262750	9.7415146	21
40	1063674	5512008	9.0268084	9.7413099	20
41	1064979	5509409	9.0273411	9.7411050	19
42	1066286	5506810	9.0278738	9.7409001	18
43	1067594	5504212	9.0284058	9.7406951	17
44	1068902	5501614	9.0289378	9.7404901	16
45	1070211	5499016	9.0294691	9.7402849	15
46	1071520	5496418	9.0300004	9.7400798	14
47	1072831	5493821	9.0305310	9.7398745	13
48	1074142	5491224	9.0310616	9.7396692	12
49	1075454	5488628	9.0315916	9.7394638	11
50	1076766	5486032	9.0321215	9.7392584	10
51	1078080	5483437	9.0326508	9.7390528	9
52	1079394	5480842	9.0331800	9.7388473	8
53	1080709	5478242	9.0337086	9.7386416	7
54	1082025	5475653	9.0342372	9.7384359	6
55	1083341	5473059	9.0347651	9.7382301	5
56	1084658	5470465	90352930	9.7380243	4
57	1085976	5467872	90358202	9.7378183	3
58	1087295	5465279	90363474	9.7376124	2
59	1088615	5462687	90368740	9.7374063	1
60	1089935	5460095	90374005	9.7372002	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

63 DEGREES.

27 DEGREES.					
M.	Natural Verſed Sine.	Natural Co-Verſed Sine.	Logarithm Verſed Sine.	Logarithm Co-Verſed Sine.	
0	1089935	5460095	9. 374005	9.7372002	60
1	1091256	5455703	9.0374264	9.7369940	59
2	1092577	5454912	9.0384522	9.7367878	58
3	1093900	5452321	9.0389774	9.7365814	57
4	1095223	5449730	9.0395026	9.7363750	56
5	1096547	5447140	9.0400272	9.7361686	55
6	1097872	5444550	9.0405517	9.7359621	54
7	1099197	5441961	9.0410755	9.7357554	53
8	1100524	5439372	9.0415994	9.7355488	52
9	1101851	5436784	9.0421226	9.7353421	51
10	1103178	5434196	9.0426458	9.7351353	50
11	1104507	5431608	9.0431683	9.7349284	49
12	1105836	5429021	9.0436908	9.7347215	48
13	1107166	5426434	9.0442127	9.7345145	47
14	1108497	5423847	9.0447345	9.7343074	46
15	1109829	5421261	9.0452557	9.7341003	45
16	1111161	5418675	9.0457769	9.7338931	44
17	1112494	5416089	9.0462975	9.7336858	43
18	1113828	5413504	9.0468180	9.7324785	42
19	1115162	5410919	9.0473379	9.7332711	41
20	1116497	5408335	9.0478578	9.7330636	40
21	1117834	5405751	9.0583770	9.7328560	39
22	1119170	5403167	9.0588962	9.7326485	38
23	1120508	5400584	9.0594147	9.7324408	37
24	1121846	5398001	9.0599333	9.7322331	36
25	1123185	5395419	9.0504512	9.7320252	35
26	1124525	5392837	9.0509691	9.7318174	34
27	1125866	5390256	9.0514864	9.7316094	33
28	1127207	5387675	9.0520036	9.7314014	32
29	1128549	5385094	9.0525202	9.7311933	31
30	1129892	5382514	9.0530368	9.7309852	30
	Natural Co-Verſed Sine.	Natural Verſed Sine.	Logarithm Co-Verſed Sine.	Logarithm Verſed Sine.	M.
62 DEGREES.					

27 DEGREES.					
M	Natural Verſed Sine.	Natural Co-Verſed Sine.	Logarithm Verſed Sine.	Logarithm Co-Verſed Sine.	
30	1129892	5382514	9.0530368	9.7309852	30
31	1131235	5379933	9.0535528	9.7307769	29
32	1132580	5377354	9.0540687	9.7305686	28
33	1133925	5374775	9.0545840	9.7303603	27
34	1135270	5372196	9.0505993	9.7301519	26
35	1136617	5369618	9.0550140	9.7299433	25
36	1137964	5367040	9.0561286	9.7297348	24
37	1139312	5364462	9.0566426	9.7295261	23
38	1140601	5361885	9.0571566	9.7293175	22
39	1142011	5359308	9.0576700	9.7291087	21
40	1143361	5356732	9.0581833	9.7288999	20
41	1144712	5354156	9.0586961	9.7286909	19
42	1146064	5351580	9.0592088	9.7284820	18
43	1147416	5349005	9.0597209	9.7282729	17
44	1148770	5346430	9.0602329	9.7280638	16
45	1150124	5343855	9.0607444	9.7278546	15
46	1151478	5341281	9.0612558	9.7276454	14
47	1152834	5338707	9.0617666	9.7274360	13
48	1154191	5336134	9.0622774	9.7272267	12
49	1155547	5333561	9.0627876	9.7270172	11
50	1156905	5330988	9.0632977	9.7268077	10
51	1158264	5328416	9.0638073	9.7265981	9
52	1159623	5325844	9.0643168	9.7262885	8
53	1160983	5323273	9.0648257	9.7261787	7
54	1162344	5320702	9.0653346	9.7259689	6
55	1163705	5318131	9.0658428	9.7257590	5
56	1165068	5315561	9.0663511	9.7255491	4
57	1166431	5312991	9.0668587	9.7253391	3
58	1167794	5310422	9.0673663	9.7251290	2
59	1169159	5307853	9.0678733	9.7249188	1
60	1170524	5305284	9.0683803	9.7247087	0
	Natural Co-Verſed Sine.	Natural Verſed Sine.	Logarithm Co-Verſed Sine.	Logarithm Verſed Sine.	M.
62 DEGREES.					

28 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	1170524	5305284	9.0683803	9.7247087	60
1	1171890	5302716	9.0688867	9.7244983	59
2	1173257	5300148	9.0693931	9.7242880	58
3	1174624	5297581	9.0698988	9.7240776	57
4	1175993	5295014	9.0704046	9.7238671	56
5	1177362	5292447	9.0709097	9.7236565	55
6	1178731	5289881	9.0714148	9.7234459	54
7	1180102	5287315	9.0719193	9.7232352	53
8	1181473	5284750	9.0724238	9.7230244	52
9	1182845	5282185	9.0729227	9.7228136	51
10	1184218	5279620	9.0734316	9.7226037	50
11	1185591	5277056	9.0739348	9.7223917	49
12	1186965	5274492	9.0744381	9.7221807	48
13	1188340	5271929	9.0749407	9.7219695	47
14	1189716	5269366	9.0754434	9.7217584	46
15	1191093	5266803	9.0759454	9.7215471	45
16	1192470	5264241	9.0764474	9.7213358	44
17	1193848	5261679	9.0769488	9.7211243	43
18	1195226	5259118	9.0774502	9.7209129	42
19	1196606	5256557	9.0779510	9.7207013	41
20	1197986	5253996	9.0784518	9.7204898	40
21	1199367	5251436	9.0789519	9.7202781	39
22	1200749	5248876	9.0794521	9.7200663	38
23	1202131	5246317	9.0799517	9.7198545	37
24	1203514	5243758	9.0804512	9.7196426	36
25	1204898	5241199	9.0809502	9.7194306	35
26	1206283	5238641	9.0814491	9.7192186	34
27	1207668	5236083	9.0819475	9.7190065	33
28	1209054	5233526	9.0824458	9.7187944	32
29	1210441	5230969	9.0829436	9.7185821	31
30	1211829	5228412	9.0834413	9.7183698	30
	Natural Co-Versed Sine	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

61 DEGREES.

28 DEGREES.

M	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	1211829	5228412	9.0834413	9.7183698	30
31	1213217	5225856	9.0839384	9.7181574	29
32	1214606	5223300	9.0844356	9.7179450	28
33	1215996	5220745	9.0849321	9.7177325	27
34	1217387	5218190	9.0854286	9.7175199	26
35	1218778	5215635	9.0859245	9.7173072	25
36	1220170	5213081	9.0864204	9.7170945	24
37	1221563	5210527	9.0869157	9.7168817	23
38	1222957	5207974	9.0874111	9.7166688	22
39	1224351	5205421	9.0879058	9.7164559	21
40	1225746	5202868	9.0884005	9.7162429	20
41	1227142	5200316	9.0888946	9.7160298	19
42	1228538	5197764	9.0893887	9.7158186	18
43	1229936	5195213	9.0898822	9.7156034	17
44	1231334	5192662	9.0903758	9.7153901	16
45	1232732	5190112	9.0908687	9.7151767	15
46	1234132	5187562	9.0913616	9.7149633	14
47	1235532	5185012	9.0918539	9.7147498	13
48	1236933	5182463	9.0923462	9.7145362	12
49	1238335	5179914	9.0923380	9.7143225	11
50	1239737	5177365	9.0933297	9.7141089	10
51	1241141	5174817	9.0938208	9.7138950	9
52	1242545	5172269	9.0943120	9.7136812	8
53	1243949	5169722	9.0948025	9.7134672	7
54	1245355	5167175	9.0952931	9.7132533	6
55	1246761	5164629	9.0957830	9.7130392	5
56	1248168	5162083	9.0962730	9.7128250	4
57	1249575	5159538	9.0967624	9.7126108	3
58	1250984	5156993	9.0972517	9.7123965	2
59	1252393	5154448	9.0977405	9.7121821	1
60	1253803	5151904	9.0982293	9.7119677	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

61 DEGREES.

29 DEGREES.					
M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	1253803	5151914	9.0982293	9.7119677	60
1	1255214	5159360	9.0987175	9.7117532	59
2	1256625	5146816	9.0992057	9.7115387	58
3	1258037	5144273	9.0996933	9.7113240	57
4	1259450	5141730	9.1001809	9.7111093	56
5	1260863	5139188	9.1006679	9.7108945	55
6	1262278	5136646	9.1011549	9.7106797	54
7	1263693	5134105	9.1016414	9.7104647	53
8	1265109	5131564	9.1021278	9.7102497	52
9	1266525	5129023	9.1026130	9.7100346	51
10	1267942	5126483	9.1030995	9.7098195	50
11	1269360	5123943	9.1035848	9.7096042	49
12	1270779	5121404	9.1040701	9.7093890	48
13	1272199	5118865	9.1045548	9.7091736	47
14	1273619	5116326	9.1050395	9.7089582	46
15	1275040	5113788	9.1055236	9.7087426	45
16	1276462	5111250	9.1060078	9.7085271	44
17	1277884	5108713	9.1064913	9.7083114	43
18	1279307	5106176	9.1069749	9.7080957	42
19	1280731	5103639	9.1074578	9.7078799	41
20	1282156	5101103	9.1079408	9.7076641	40
21	1283581	5098567	9.1084232	9.7074481	39
22	1285007	5096032	9.1089056	9.7072321	38
23	1286434	5093497	9.1093875	9.7070160	37
24	1287862	5090963	9.1098693	9.7067999	36
25	1289290	5088429	9.1103506	9.7065836	35
26	1290719	5085895	9.1108318	9.7063674	34
27	1292149	5083362	9.1113125	9.7061510	33
28	1293580	5080829	9.1117932	9.7059346	32
29	1295011	5078297	9.1122733	9.7057180	31
30	1296443	5075765	9.1127534	9.7055015	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.
60 DEGREES.					

29 DEGREES.					
M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	1296443	5075765	9.1127534	9.7055015	30
31	1297876	5073233	9.1132330	9.7052848	29
32	1299309	5070702	9.1137126	9.7050681	28
33	1300744	5068171	9.1141915	9.7048512	27
34	1302179	5065641	9.1146705	9.7046344	26
35	1303614	5063111	9.1151490	9.7044174	25
36	1305051	5060582	9.1156274	9.7042004	24
37	1306488	5058053	9.1161052	9.7039833	23
38	1307926	5055524	9.1165831	9.7037661	22
39	1309364	5052996	9.1170604	9.7035489	21
40	1310804	5050468	9.1175377	9.7033316	20
41	1312244	5047941	9.1180145	9.7031742	19
42	1313685	5045414	9.1184912	9.7028967	18
43	1315126	5042887	9.1189674	9.7026792	17
44	1316569	5040361	9.1194436	9.7024616	16
45	1318012	5037835	9.1199192	9.7022439	15
46	1319456	5035310	9.1203948	9.7020262	14
47	1320900	5032785	9.1208699	9.7018083	13
48	1322345	5030260	9.1213449	9.7015905	12
49	1323791	5027736	9.1218194	9.7013725	11
50	1325238	5025212	9.1222939	9.7011545	10
51	1326686	5022689	9.1227679	9.7009363	9
52	1328134	5020166	9.1232419	9.7007182	8
53	1329583	5017644	9.1237153	9.7004999	7
54	1331033	5015122	9.1241887	9.7002816	6
55	1332483	5012601	9.1246615	9.7000631	5
56	1333934	5010080	91251344	9.6998447	4
57	1335386	5007559	91256057	9.6996271	3
58	1336839	5005039	91260790	9.6994075	2
59	1338292	5002519	91265507	9.6991887	1
60	1339746	5000000	91270225	9.6989700	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.
60 DEGREES.					

30 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine	Logarithm Co-Versed Sine.	
0	1339746	5000000	9.1270225	9.6989700	60
1	1341201	4997481	9.1274937	9.6987511	59
2	1342656	4994962	9.1279649	9.6985322	58
3	1344113	4992444	9.1284355	9.6983132	57
4	1345570	4989926	9.1289062	9.6980942	56
5	1347027	4987409	9.1293763	9.6978750	55
6	1348486	4984892	9.1298464	9.6976558	54
7	1349945	4982376	9.1303159	9.6974365	53
8	1351405	4979860	9.1307855	9.6972172	52
9	1352866	4977344	9.1312545	9.6969977	51
10	1354327	4974829	9.1317235	9.6967782	50
11	1355789	4972314	9.1321920	9.6965586	49
12	1357252	4969800	9.1326605	9.6963390	48
13	1358716	4967286	9.1331284	9.6961192	47
14	1360180	4964773	9.1335964	9.6958994	46
15	1361645	4962260	9.1340637	9.6956795	45
16	1363111	4959747	9.1345311	9.6954596	44
17	1364577	4957235	9.1349980	9.6952395	43
18	1366044	4954723	9.1354648	9.6950194	42
19	1367512	4952212	9.1359312	9.6647992	41
20	1368981	4949701	9.1363975	9.6945790	40
21	1370451	4947191	9.1368633	9.6943587	39
22	1371921	4944681	9.1373290	9.6941383	38
23	1373392	4942171	9.1377943	9.6939178	37
24	1374863	4939662	9.1382595	9.6936973	36
25	1376336	4937153	9.1387242	9.6934766	35
26	1377809	4934645	9.1391889	9.6932559	34
27	1379283	4932137	9.1396531	9.6930351	33
28	1380757	4929630	9.1401173	9.6928143	32
29	1382232	4927123	9.1405809	9.6925934	31
30	1383708	4924616	9.1410446	9.6923724	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M

59 DEGREES.

30 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	1383708	4924616	9.1410446	9.6923724	30
31	1385185	4922110	9.1415077	9.6921513	29
32	1386663	4919604	9.1419708	9.6919302	28
33	1388141	4917099	9.1424334	9.6917089	27
34	1389620	4914594	9.1428960	9.6914877	26
35	1391099	4912089	9.1433580	9.6912663	25
36	1392580	4909585	9.1438201	9.6910449	24
37	1394061	4907081	9.1442816	9.6908233	23
38	1395543	4904578	9.1447431	9.6906017	22
39	1397025	4902075	9.1452041	9.6903800	21
40	1398509	4899573	9.1456651	9.6901583	20
41	1399993	4897071	9.1461256	9.6899365	19
42	1401477	4894570	9.1465861	9.6897146	18
43	1402963	4892069	9.1470460	9.6894926	17
44	1404449	4889569	9.1475060	9.6892706	16
45	1405936	4887069	9.1479654	9.6890484	15
46	1407424	4884569	9.1484248	9.6888263	14
47	1408912	4882070	9.1488837	9.6886040	13
48	1410401	4879571	9.1493426	9.6883817	12
49	1411891	4877073	9.1498010	9.6881592	11
50	1413381	4874575	9.1502594	9.6879368	10
51	1414873	4872078	9.1507172	9.6877141	9
52	1416365	4869581	9.1511751	9.6874915	8
53	1417857	4867084	9.1516324	9.6872688	7
54	1419351	4864588	9.1520898	9.6870460	6
55	1420845	4862092	9.1525466	9.6868231	5
56	1422340	4859597	91530034	9.6866002	4
57	1423836	4857102	91534597	9.6863771	3
58	1425332	4854607	91539161	9.6861541	2
59	1426829	4852113	91543719	9.6859309	1
60	1428327	4849619	91548276	9.6857076	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

59 DEGREES.

31 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	1428327	4849619	9.1548276	9.6857076	60
1	1429826	4847126	9.1552829	9.6854843	59
2	1431325	4844633	9.1557382	9.6852609	58
3	1432825	4842141	9.1561930	9.6850374	57
4	1434326	4839649	9.1566477	9.6848139	56
5	1435827	4837157	9.1561020	9.6845902	55
6	1437329	4834666	9.1575562	9.6843665	54
7	1438832	4832175	9.1580100	9.6841427	53
8	1440336	4829685	9.1584637	9.6839189	52
9	1441840	4827195	9.1589169	9.6836949	51
10	1443345	4824706	9.1593702	9.6834710	50
11	1444851	4822217	9.1598229	9.6832468	49
12	1446357	4819729	9.1602756	9.6830227	48
13	1447865	4817241	9.1607278	9.6827984	47
14	1449373	4814754	9.1611800	9.6825741	46
15	1450881	4812267	9.1616318	9.6823497	45
16	1452391	4809780	9.1620835	9.6821253	44
17	1453901	4807294	9.1625347	9.6819007	43
18	1455412	4804808	9.1629859	9.6816761	42
19	1456923	4802323	9.1634366	9.6814514	41
20	1458436	4799838	9.1638873	9.6812266	40
21	1459949	4797354	9.1643374	9.6810018	39
22	1461462	4794870	9.1647876	9.6807769	38
23	1462977	4792386	9.1652373	9.6805518	37
24	1464492	4789903	9.1656870	9.6803268	36
25	1466008	4787420	9.1661362	9.6801016	35
26	1467525	4784938	9.1665854	9.6798764	34
27	1469042	4782456	9.1670341	9.6796510	33
28	1470560	4779975	9.1674828	9.6794257	32
29	1472079	4777494	9.1679309	9.6792002	31
30	1473598	4775014	9.1683791	9.6789747	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm-Versed Sine.	M.

58 DEGREES.

31 DEGREES.

M	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	1473598	4775014	9.1683791	9.6789747	30
31	1475119	4772534	9.1688268	9.6787490	29
32	1476640	4770054	9.1692745	9.6785234	28
33	1478161	4767575	9.1697217	9.6782976	27
34	1479684	4765096	9.1701689	9.6780717	26
35	1481207	4762618	9.1706156	9.6778458	25
36	1482731	4760140	9.1710623	9.6776198	24
37	1484255	4757663	9.1715085	9.6773937	23
38	1485781	4755186	9.1719547	9.6771676	22
39	1487307	4752710	9.1724004	9.6769413	21
40	1488833	4750234	9.1728461	9.6767150	20
41	1490361	4747759	9.1732913	9.6764886	19
42	1491889	4745284	9.1737365	9.6762622	18
43	1493418	4742809	9.1741812	9.6760356	17
44	1494947	4740335	9.1746259	9.6758090	16
45	1496478	4737861	9.1750701	9.6755823	15
46	1498009	4735388	9.1755144	9.6753555	14
47	1499541	4732915	9.1759581	9.6751286	13
48	1501073	4730443	9.1764018	9.6749017	12
49	1502506	4727971	9.1768451	9.6746747	11
50	1504140	4725499	9.1772883	9.6744476	10
51	1505675	4723028	9.1777311	9.6742204	9
52	1507210	4720557	9.1781738	9.6739932	8
53	1508746	4718087	9.1786161	9.6737659	7
54	1510283	4715617	9.1790584	9.6735385	6
55	1511821	4713148	9.1795002	9.6733110	5
56	1513358	4710679	9.1799419	9.6730835	4
57	1514898	4708211	9.1803832	9.6728558	3
58	1516438	4705743	9.1808245	9.6726281	2
59	1517978	4703275	9.1812653	9.6724003	1
60	1519519	4700808	9.1817061	9.6721725	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Veſed Sine.	M.

58 DEGREES.

32 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	1519519	4700008	9.1817061	9.6721725	60
1	1521061	4698341	9.1821465	9.6719445	59
2	1522603	4695875	9.1825868	9.6717165	58
3	1524147	4693409	9.1830266	9.6714883	57
4	1525691	4690944	9.1834665	9.6712602	56
5	1527235	4688479	9.1839059	9.6710319	55
6	1528781	4686015	9.1843452	9.6708036	54
7	1530327	4683551	9.1847841	9.6705751	53
8	1531874	4681087	9.1852230	9.6703467	52
9	1533421	4678624	9.1856614	9.6701181	51
10	1534970	4676161	9.1860998	9.6698895	50
11	1536519	4673699	9.1865377	9.6696607	49
12	1538068	4671237	9.1869756	9.6694319	48
13	1539619	4668776	9.1874131	9.6692030	47
14	1541170	4666315	9.1878505	9.6689741	46
15	1542722	4663855	9.1872875	9.6687450	45
16	1544274	4661395	9.1887245	9.6685[illegible]9	44
17	1545828	4658935	9.1891610	9.66[illegible]7	43
18	1547382	4656476	9.1895974	9.6680574	42
19	1548936	4654017	9.1900335	9.6678280	41
20	1550492	4651559	9.1904695	9.6675986	40
21	1552048	4649102	9.1909050	9.6673691	39
22	1553605	4646645	9.1913406	9.6671395	38
23	1555162	4644188	9.1917756	9.6669098	37
24	1556721	4641732	9.1922107	9.6666801	36
25	1558280	4639276	9.1926453	9.6664502	35
26	1559839	4636821	9.1930799	9.6662203	34
27	1561400	4634366	9.1935140	9.6659903	33
28	1562961	4631912	9.1939482	9.6657603	32
29	1564523	4629458	9.1943818	9.6655301	31
30	1566086	4627004	9.1948155	9.6652989	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

57 DEGREES.

32 DEGREES.

M	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	1566086	4627004	9.1948155	9.6652989	30
31	1567649	4624551	9.1952487	9.6650695	29
32	1569213	4622098	9.1956819	9.6648392	28
33	1570778	4619646	9.1961146	9 6646087	27
34	1572343	4617194	9.1965473	9.6643781	26
35	1573909	4614742	9.1969795	9.6741475	25
36	1575476	4612291	9.1974118	9.6639168	24
37	1577044	4609841	9.1978436	9.6636860	23
38	1578612	4607391	9.1982754	9.6634552	22
39	1580181	4604942	9.1987067	9.6632242	21
40	1581751	4602493	9.1991380	9.6629932	20
41	1583321	4600045	9.1995689	9.6627620	19
42	1584892	4597597	9.1999997	9.6625309	18
43	1586464	4595149	9.2004301	9.6622996	17
44	1588037	4592702	9.2008605	9.6620683	16
45	1589610	4590255	9.2012904	9.6618368	15
46	1591184	4587809	9.2017204	9.6616053	14
47	1592759	4585363	9.2021498	9.6613737	13
48	1594334	4582918	9.2025793	9.6611421	12
49	1595910	4580473	9.2030083	9.6609103	11
50	1597487	4578028	9.2034373	9.6606785	10
51	1599064	4575584	9.2038659	9.6604466	9
52	1600643*	4573141	9.2042944	9.6602146	8
53	1602222	4570698	9.2047225	9.6599825	7
54	1603801	4568255	9.2051506	9.6597504	6
55	1605382	4565813.	9.2055782	9.6595181	5
56	1606963	4563371	9.2060058	9.6592858	4
57	1608545	4560930	9.2064330	9.6590534	3
58	1610127	4558490	9.2068602	9.6588210	2
59	1611710	4556050	9.2072869	9.6585884	1
60	1613294	4553610	9.2077136	9.6583558	0
	Natural Co Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

57 DEGREES.

33 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	1613294	4553610	9.2077136	9.6583558	60
1	1614879	4551171	9.2081399	9.6581230	59
2	1616464	4548732	9.2085661	9.6578903	58
3	1618050	4546293	9.2089919	9.6576574	57
4	1619637	4543855	9.2094177	9.6574245	56
5	1621225	4541417	9.2098431	9.6571914	55
6	1622813	4538980	9.2102684	9.6569583	54
7	1624402	4536543	9.2106933	9.6567251	53
8	1625991	4534108	9.2111182	9.6564918	52
9	1627582	4531672	9.2115427	9.6562584	51
10	1629173	4529237	9.2119671	9.6560250	50
11	1630764	4526802	9.2123911	9.6557915	49
12	1632357	4524368	9.2128151	9.6555579	48
13	1633950	4521934	9.2132387	9.6553242	47
14	1635544	4519501	9.2136622	9.6550904	46
15	1637138	4517068	9.2140853	9.6548566	45
16	1638734	4514636	9.2145084	9.6546227	44
17	1640330	4512204	9.2149310	9.6543886	43
18	1641926	4509772	9.2153537	9.6541546	42
19	1643524	4507341	9.2157759	9.6539204	41
20	1645122	4504910	9.2161981	9.6536861	40
21	1646721	4502480	9.2166198	6.6534518	39
22	1648320	4500050	9.2170416	9.6532174	38
23	1649920	4497621	9.2174629	9.6529828	37
24	1651521	4495192	9.2178842	9.6527483	36
25	1653123	4492764	9.2183051	9.6525136	35
26	1654725	4490336	9.2187259	9.6522789	34
27	1656328	4487909	9.2191463	9.6520440	33
28	1657932	4485482	9.2195668	9.6518092	32
29	1659537	4483056	9.2199867	9.6515741	31
30	1661142	4480630	9.2204067	9.6513391	30
	Natural Co-Versed Sine	Natural Versed Sine.	Logarithm Co Versed Sine.	Logarithm Versed Sine.	M.

56 DEGREES.

33 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	1661142	4480630	9.2204067	9.6513391	30
31	1662748	4478205	9.2208262	9.6511039	29
32	1664354	4475780	9.2212458	9.6508687	28
33	1665962	4473355	9.2216649	9.6506333	27
34	1667570	4470931	9.2220839	9.6503980	26
35	1669178	4468507	9.2225026	9.6501625	25
36	1670788	4466084	9.2229212	9.6499269	24
37	1672398	4463662	9.2233395	9.6496912	23
38	1674009	4461240	9.2237577	9.6494556	22
39	1675620	4458818	9.2241754	9.6492197	21
40	1677232	4456397	9.2245932	9.6489839	20
41	1678845	4453976	9.2250105	9.6487478	19
42	1680459	4451556	9.2254279	9.6485118	18
43	1682073	4449136	9.2258448	9.6482756	17
44	1683688	4446717	9.2262617	9.6480394	16
45	1685304	4444298	9.2266781	9.6478031	15
46	1686920	4441880	9.2270946	9.6475667	14
47	1688537	4439462	9.2275106	9.6473302	13
48	1690155	4437044	9.2279266	9.6470937	12
49	1691774	4434627	9.2283422	9.6468570	11
50	1693393	4432210	9.2287578	9.6466204	10
51	1695013	4429794	9.2291729	9.6463835	9
52	1696634	4427378	9.2295881	9.6461467	8
53	1698255	4424963	9.2300028	9.6459097	7
54	1699877	4422548	9.2304175	9.6456726	6
55	1701500	4420134	9.2308318	9.6454355	5
56	1703123	4417720	9.2312461	9.6451983	4
57	1704748	4415307	9.2316600	9.6449609	3
58	1706372	4412894	9.2320738	9.6447236	2
59	1707998	4410482	9.2324872	9.6444861	1
60	1709624	4408071	9.2329007	9.6442486	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

56 DEGREES.

34 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	1709624	4408071	9.2329007	9.6442486	60
1	1711251	4405660	9.2333137	9.6440109	59
2	1712879	4403249	9.2337267	9.6437732	58
3	1714507	4400839	9.2341392	9.6435354	57
4	1716136	4398429	9.2345518	9.6432975	56
5	1717766	4396019	9.2349639	9.6430595	55
6	1719397	4393610	9.2353761	9.6428215	54
7	1721028	4391202	9.2357878	9.6425833	53
8	1722660	4388794	9.2361935	9.6423452	52
9	1724292	4386386	9.2366108	9.6421068	51
10	1725926	4383979	9.2370221	9.6418685	50
11	1727560	4381573	9.2374329	9.6416299	49
12	1729194	4379167	9.2378438	9.6413914	48
13	1730830	4376761	9.2382542	9.6411527	47
14	1732466	4374356	9.2386647	9.6409141	46
15	1734103	4371951	9.2390747	9.6406752	45
16	1735740	4369547	9.2394847	9.6404364	44
17	1737378	4367143	9.2398943	9.6401973	43
18	1739017	4364740	9.2403038	9.6399583	42
19	1740657	4362337	9.2407130	9.6397191	41
20	1742297	4359934	9.2411222	9.6394800	40
21	1743938	4357532	9.2415309	9.6392406	39
22	1745580	4355131	9.2419396	9.6390012	38
23	1747222	4352730	9.2423480	9.6387617	37
24	1748865	4350330	9.2427563	9.6385222	36
25	1750509	4347930	9.2431642	9.6382825	35
26	1752153	4345531	9.2435721	9.6380428	34
27	1753798	4343132	9.2439796	9.6378030	33
28	1755444	4340734	9.2443871	9.6375633	32
29	1757091	4338336	9.2441941	9.6373231	31
30	1758738	4335938	9.2452012	9.6370830	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M

55 DEGREES.

34 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	1758738	4335938	9.2452012	9.6370830	30
31	1760386	4333541	9.2456078	9.6368428	29
32	1762035	4331144	9.2460145	9.6366016	28
33	1763684	4328748	9.2464207	9.6363623	27
34	1765334	4326352	9.2468269	9.6361219	26
35	1766985	4323957	9.2472327	9.6358813	25
36	1768636	4321562	9.2476385	9.6356408	24
37	1770288	4319168	9.2480439	9.6354001	23
38	1771941	4316774	9.2484493	9.6351594	22
39	1773595	4314381	9.2488543	9.6349185	21
40	1775249	4311988	9.2492593	9.6346776	20
41	1776904	4309596	9.2496619	9.6344366	29
42	1778560	4307204	9.2500684	9.6341955	18
43	1780216	4304813	9.2504726	9.6339543	17
44	1781873	4302422	9.2508767	9.6337131	16
45	1783531	4300032	9.2512805	9.6334717	15
46	1785189	4297642	9.2516842	9.6332303	14
47	1786848	4295253	9.2520875	9.6329887	13
48	1788508	4292864	9.2524909	9.6327472	12
49	1790168	4290476	9.2528938	9.6325054	11
50	1791830	4288088	9.2532967	9.6322637	10
51	1793491	4285701	9.2536992	9.6320218	9
52	1795154	4283314	9.2541017	9.6317799	8
53	1796817	4280928	9.2545038	9.6315378	7
54	1798481	4278542	9.2549059	9.6312957	6
55	1800146	4276156	9.2553076	9.6310535	5
56	1801811	4273771	9.2557093	9.6308112	4
57	1803477	4271387	9.2561106	9.6305688	3
58	1805144	4269003	9.2565119	9.6303264	2
59	1806811	4266619	9.2569127	9.6300838	1
60	1808480	4264236	9.2573136	9.6298412	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

55 DEGREES.

35 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	1808480	4264236	9.2573136	9.6298412	60
1	1810148	4261853	9.2577141	9.6295984	59
2	1811818	4259471	9.2581145	9.6293557	58
3	1813488	4257089	9.2585146	9.6291127	57
4	1815159	4254708	9.2589147	9.6288698	56
5	1816831	4252328	9.2593143	9.6286267	55
6	1818502	4249948	9.2597140	9.6283836	54
7	1820176	4247568	9.2601132	9.6281403	53
8	1821849	4245189	9.2605125	9.6278970	52
9	1823524	4242810	9.2609113	9.6276535	51
10	1825199	4240432	9.2613102	9.6274101	50
11	1826875	4238054	9.2617086	9.6271664	49
12	1828551	4235677	9.2621071	9.6269228	48
13	1830228	4233300	9.2625051	9.6266790	47
14	1831906	4230924	9.2629032	9.6264352	46
15	1833584	4228548	9.2633008	9.6261912	45
16	1835264	4226173	9.2636985	9.6259473	44
17	1836944	4223798	9.2640957	9.6257031	43
18	1838624	4221424	9.2644929	9.6254589	42
19	1840305	4219050	9.2648898	9.6252146	41
20	1841987	4216676	9.2658266	9.6249703	40
21	1843670	4214303	9.2656831	9.6247258	39
22	1845353	4211931	9.2660795	9.6244813	38
23	1847037	4209559	9.2664756	9.6242366	37
24	1848722	4207188	9.2668716	9.6239919	36
25	1850407	4204817	9.2672673	9 6237471	35
26	1852094	4202447	9.2676729	9.6235022	34
27	1853780	4200077	9.2680582	9.6232572	33
28	1855468	4197708	9.2684534	9.6230122	32
29	1857156	4195339	9.2688483	9.6227670	31
30	1858845	4192970	9.2692431	9.6225218	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M

54 DEGREES.

35 DEGREES.

M	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	1858845	4192970	9.2692431	9.6225218	30
31	1860534	4190602	9.2696376	9.6222764	29
32	1862225	4188234	9.2700321	9.6220311	28
33	1863916	4185867	9.2704261	9.6217855	27
34	1865607	4183501	9.2708202	9.6215400	26
35	1867299	4181135	9.2712139	9.6212942	25
36	1868992	4178770	9.2716075	9.6210485	24
37	1870686	4176405	9.2720008	9.6208026	23
38	1872380	4174041	9.2723941	9.6205567	22
39	1874075	4171677	9.2727870	9.6203106	21
40	1875771	4169313	9.2731799	9.6200645	20
41	1877468	4166950	9.2735724	9.6198183	19
42	1879165	4164588	9.2739649	9.6195720	18
43	1880863	4162226	9.2743570	9.6193256	17
44	1882561	4159864	9.2747491	9.6190792	16
45	1884260	4157503	9.2751408	9.6188326	15
46	1885960	4155142	9.2755325	9.6185860	14
47	1887661	4152782	9.2759238	9.6183392	13
48	1889362	4150422	9 2763151	9.6180924	12
49	1891064	4148063	9 2767061	9.6178454	11
50	1892766	4145705	9.2770970	9.6175985	10
51	1894470	4143347	9.2774875	9.6173513	9
52	1896174	4140990	9.2778781	9.6171042	8
53	1897878	4138633	9.2782683	9.6168569	7
54	1899584	4136276	9.2786584	9.6166096	6
55	1901290	4133920	9.2790482	9.6163621	5
56	1902996	4131564	9.2794380	9.6161146	4
57	1904704	4129200	9.2798273	9.6158669	3
58	1906412	4126855	9.2802167	9.6156192	2
59	1908121	4124501	9.2806657	9.6153714	1
60	1009830	4122148	9.2809947	9.6151235	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

54 DEGREES.

36 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	1909830	4122148	9.2809947	9.6151235	60
1	1911540	4119795	9.2813833	9.6148755	59
2	1913251	4117442	9.2817720	9.6146275	58
3	1914963	4115090	9.2821602	9.6143793	57
4	1916675	4112738	9.2825484	9.6141311	56
5	1918388	4110387	9.2829363	9.6138827	55
6	1920101	4108036	9.2833241	9.6136343	54
7	1921815	4105686	9.2837116	9.6133857	53
8	1923530	4103336	9.2840990	9.6131372	52
9	1925246	4100987	9.2844861	9.6128884	51
10	1926962	4098639	9.2848732	9.6126397	50
11	1988679	4096291	9.2852599	9.6123907	49
12	1930397	4093944	9.2856466	9.6121418	48
13	1932115	4091597	9.2860329	9.6118927	47
14	1933834	4089250	9.2864192	9.6116436	46
15	1935554	4086904	9.2868052	9.6113943	45
16	1937274	4084558	9.2871911	9.6111451	44
17	1938995	4082213	9.2875767	9.6108956	43
18	1940717	4079868	9.2879622	9.6106461	42
19	1942440	4077524	9.2883474	9.6103965	41
20	1944163	4075180	9.2887326	9.6101469	40
21	1945887	4072837	9.2891174	9.6098970	39
22	1947611	4070495	9.2895022	9.6096472	38
23	1949336	4068153	9.2898866	9.6093972	37
24	1951062	4065811	9.2902711	9.6091472	36
25	1952789	4063470	9.2906551	9.6088970	35
26	1954516	4061129	9.2910392	9.6086468	34
27	1956244	4058789	9.2914229	9.6083965	33
28	1957972	4056449	9.2918065	9.6081461	32
29	1959701	4054110	9.2921898	9.6078956	31
30	1961431	4051772	9.2925731	9.6076450	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

53 DEGREES.

36 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	1961431	4051772	9.2925731	9.6076450	30
31	1963162	4049434	9.2929560	9.6073943	29
32	1964893	4047096	9.2933390	9.6071346	28
33	1966625	4044759	9.2937215	9.6068927	27
34	1968358	4042422	9.2941041	9.6066417	26
35	1970091	4040086	9.2944862	9.6063907	25
36	1971825	4037750	9.2948684	9.6061396	24
37	1973560	4035415	9.2952502	9.6058883	23
38	1975295	4033081	9.2956320	9.6056370	22
39	1977031	4030747	9.2960135	9.6053856	21
40	1978768	4028414	9.2963949	9.6051341	20
41	1980505	4026081	9.2967760	9.6048825	19
42	1982244	4023749	9.2971570	9.6046308	18
43	1983982	4021417	9.2975377	9.6043790	17
44	1985722	4019083	9.2979184	9.6041272	16
45	1987462	4016754	9.2982987	9.6038752	15
46	1989203	4014423	9.2986790	9.6036232	14
47	1990944	4012093	9.2990590	9.6033710	13
48	1992686	4009763	9.2994389	9.6031188	12
49	1994429	4007434	9.2998185	9.6028664	11
50	1996173	4005106	9.3001981	9.6026143	10
51	1997917	4002778	9.3005773	9.6023615	9
52	1999662	4000451	9.3009565	9.6021090	8
53	2001407	3998124	9.3013354	9.6018562	7
54	2003154	3995798	9.3017142	9.6016035	6
55	2004900	3993472	9.3020927	9.6013506	5
56	2006648	3991147	9.3024712	9.6010976	4
57	2008396	3988822	9.3028493	9.6008446	3
58	2010145	3986498	9.3032274	9.6005914	2
59	2011895	3984174	9.3036051	9.6003382	1
60	2013645	3981850	9.3039829	9.6000849	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

53 DEGREES.

37 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	2013645	3981850	9.3039829	9.6000849	60
1	2015396	3979527	9.3043603	9.5998314	59
2	2017147	3977204	9.3047376	9.5995779	58
3	2018900	3974882	9.3051147	9.5993243	57
4	2020653	3972561	9.3054917	9.5990706	56
5	2022406	3970240	9.3058683	9.5988168	55
6	2024161	3967920	9.3062450	9.5985629	54
7	2025916	3965600	9.3066213	9.5983089	53
8	2027671	3963281	9.3069976	9.5980549	52
9	2029428	3960962	9.3073735	9.5978007	51
10	2031185	3958643	9.3077494	9.5975464	50
11	2032942	3956325	9.3081250	9.5972920	49
12	2034701	3954008	9.3085006	9.5970376	48
13	2036460	3951691	9.3088758	9.5967831	47
14	2038220	3949375	9.3092510	9.5965285	46
15	2039980	3947060	9.3096258	9.5962737	45
16	2041741	3944745	9.3100007	9.5960189	44
17	2043503	3942430	9.3103572	9.5957640	43
18	2045265	3940116	9.3107496	9.5955090	42
19	2047028	3937802	9.3111238	9.5952539	41
20	2048792	3935489	9.3114979	9.5949987	40
21	2050556	3933176	9.3118716	9.5947434	39
22	2052322	3930864	9.3122454	9.5944881	38
23	2054087	3928552	9.3126188	9.5942325	37
24	2055854	3926241	9.3129922	9.5939770	36
25	2057621	3923931	9.3133653	9.5937213	35
26	2059389	3921621	9.3137383	9.5934656	34
27	2061157	3919312	9.3141110	9.5932097	33
28	2062926	3917003	9.3144837	9.5929538	32
29	2064696	3914694	9.3148561	9.5926977	31
30	2066467	3912386	9.3152284	9.5924417	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

52 DEGREES.

37 DEGREES.

M	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	2066467	3912386	9.3152284	9.5924417	30
31	2068238	3910078	9.3156004	9.5921854	29
32	2070010	3907771	9.3159724	9.5919291	28
33	2071782	3905464	9.3163440	9.5916727	27
34	2073555	3903158	9.3167156	9.5914162	26
35	2075329	3900853	9.3170869	9.5911599	25
36	2077104	3898548	9.3174582	9.5909029	24
37	2078879	3896244	9.3178291	9.5906461	23
38	2080655	3893940	9.3182000	9.5903893	22
39	2082431	3891636	9.3185706	9.5901322	21
40	2084208	3889333	9.3189413	9.5898752	20
41	2085986	3887030	9.3193113	9.5896180	19
42	2087765	3884728	9.3196815	9.5893608	18
43	2089544	3882427	9.3200514	9.5891034	17
44	2091324	3880127	9.3204213	9.5888460	16
45	2093104	3877827	9.3207908	9.5885884	15
46	2094885	3875527	9.3211603	9.5883308	14
47	2096667	3873228	9.3215294	9.5880730	13
48	2098450	3870929	9.3218986	9.5878153	12
49	2100233	3868631	9.3222674	9.5875573	11
50	2102017	3866333	9.3226362	9.5872993	10
51	2103802	3864035	9.3230047	9.5870412	9
52	2105587	3861739	9.3233731	9.5867830	8
53	2107373	3859443	9.3237412	9.5865247	7
54	2109159	3857147	9.3241094	9.5862663	6
55	2110946	3854852	9.3244771	9.5860078	5
56	2112734	3852558	9.3248449	9.5857492	4
57	2114523	3850264	9.3252123	9.5854905	3
58	2116312	3847970	9.3255797	9.5852318	2
59	2118102	3845677	9.3259468	9.5849728	1
60	2119892	3843385	9.3263138	9.5847139	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M

52 DEGREES.

38 DEGREES.

M.	Natural Versed Sine	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	2119892	3843385	9.3263138	9.5847139	60
1	2121884	3841093	9.3266805	9.5844548	59
2	2123476	3838802	9.3270473	9.5841957	58
3	2125268	3836511	9.3274136	9.5839364	57
4	2127061	3834220	9.3277800	9.5836771	56
5	2128855	3831930	9.3281460	9.5834176	55
6	2130650	3829641	9.3285121	9.5831581	54
7	2132445	3827352	9.3288778	9.5828984	53
8	2134241	3825064	9.3292434	9.5826387	52
9	2136037	3822776	9.3296088	9.5823788	51
10	2137835	3820488	9.3299741	9.5821190	50
11	2139633	3818201	9.3303391	9.5818589	49
12	2141431	3815915	9.3307042	9.5815988	48
13	2143230	3813629	9.3310688	9.5813385	47
14	2145030	3811344	9.3314334	9.5810783	46
15	2146831	3809060	9.3317977	9.5808178	45
16	2148632	3806776	9.3321620	9.5805574	44
17	2150434	3804492	9.3325260	9.5802967	43
18	2152236	3802209	9.3328900	9.5800361	42
19	2154039	3799926	9.3332536	9.5797752	41
20	2155843	3797644	9.3336172	9.5795144	40
21	2157648	3795362	9.3339805	9.5792533	39
22	2159453	3793081	9.3343438	9.5789923	38
23	2161259	3790801	9.3347067	9.5787311	37
24	2163065	3788521	9.3350697	9.5784698	36
25	2164873	3786242	9.3354323	9.5782084	35
26	2166680	3783963	9.3357949	9.5779470	34
27	2168489	3781685	9.3361571	9.5776854	33
28	2170298	3779407	9.3368194	9.5774237	32
29	2172108	3777130	9.3368813	9.5771619	31
30	2173918	3774854	9.3372432	9.5769001	30
	Natural Co-Versed Sine	Natural Versed Sine.	Logarithm Co Versed Sine.	Logarithm Versed Sine.	M.

51 DEGREES

38 DEGREES.

M	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	2173918	3774854	9.3372432	9.5769001	30
31	2175370	3772578	9.3376048	9.5766381	29
32	2177451	3770302	9.3379664	9.5763761	28
33	2179534	3768027	9.3383277	9.5761139	27
34	2181167	3765752	9.3386889	9.5758517	26
35	2182981	3763478	9.3390498	9.5755893	25
36	2184795	3761204	9.3394107	9.5753269	24
37	2186610	3758931	9.3397713	9.5750643	23
38	2188426	3756658	9.3401319	9.5748417	22
39	2190243	3754386	9.3404921	9.5745389	21
40	2192060	3752115	9.3408524	9.5742761	20
41	2193877	3749844	9.3412123	9.5740131	19
42	2195696	3747574	9.3415722	9.5737502	18
43	2197515	3745304	9.3419318	9.5734870	17
44	2199335	3743034	9.3422913	9.5732218	16
45	2201155	3740765	9.3426506	9.5729604	15
46	2202976	3738497	9.3430098	9.5726970	14
47	2204798	3736229	9.3433687	9.5724335	13
48	2206620	3733962	9.3437276	9.5721699	12
49	2208443	3731695	9.3440862	9.5719061	11
50	2210267	3729428	9.3444448	9.5716423	10
51	2212096	3727162	9.3448030	9.5713784	9
52	2213916	3724897	9.3451612	9.5711144	8
53	2215742	3722632	9.3455191	9.5708502	7
54	2217569	3720368	9.3458770	9.5705861	6
55	2219396	3718105	9.3462346	9.5703217	5
56	2221223	3715842	9.3465921	9.5700573	4
57	2223051	3713580	9.3469494	9.5697928	3
58	2224880	3711318	9.3473067	9.5695282	2
59	2226710	3709057	9.3476636	9.5692635	1
60	2228540	3706796	9.3480205	9.5689987	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarthim Versed Sine.	M

51 DEGREES.

39 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	2228540	3706796	9.3480205	9.5689987	60
1	2230371	3704536	9.3483771	9.5687337	59
2	2232203	3702276	9.3487337	9.5684688	58
3	2234035	3700017	9.3490899	9.5682036	57
4	2235868	3697758	9.3494462	9.5679385	56
5	2237702	3695499	9.3498021	9.5676731	55
6	2239536	3693241	9.3501580	9.5674078	54
7	2241371	3690984	9.3505136	9.5671422	53
8	2243206	3688727	9.3508692	9.5668766	52
9	2245043	3686471	9.3512245	9.5666109	51
10	2246879	3684216	9.3515798	9.5663451	50
11	2248717	3681961	9.3519347	9.5660792	49
12	2250555	3679707	9.3522897	9.5658132	48
13	2252394	3677453	9.3526443	9.5655471	47
14	2254233	3675200	9.3529989	9.5652804	46
15	2256074	3672947	9.3533532	9.5649564	45
16	2257914	3670695	9.3537075	9.5647482	44
17	2259756	3668443	9.3540614	9.5644817	43
18	2261598	3666192	9.3544454	9.5642151	42
19	2263441	3663941	9.3547690	9.5639484	41
20	2265284	3661690	9.3551227	9.5636816	40
21	2267128	3659440	9.3554760	9.5634147	39
22	2268973	3657191	9.3558293	9.5631477	38
23	2270818	3654942	9.3561823	9.5628805	37
24	2272664	3652694	9.3565353	9.5626134	36
25	2274511	3650447	9.3568880	9.5623460	35
26	2276358	3648200	9.3572406	9.5620787	34
27	2278206	3645954	9.3575930	9.5618111	33
28	2280055	3643708	9.3579453	9.5615436	32
29	2281904	3641463	9.3582973	9.5612758	31
30	2283754	3639218	9.3586494	9.5610080	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co Versed Sine.	Logarithm Versed Sine.	M.

50 DEGREES.

39 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co Versed Sine.	
30	2283754	3639218	9.3586493	9.5610080	30
31	2285605	3636974	9.3590011	9.5607401	29
32	2287456	3634730	9.3593528	9.5604721	28
33	2289308	3632487	9.3597041	9.5602040	27
34	2291160	3630244	9.3600555	9.5599358	26
35	2293014	3628001	9.3604066	9.5596674	25
36	2294868	3625759	9.3607576	9.5593991	24
37	2296722	3623518	9.3611084	9.5591305	23
38	2298577	3621278	9.3614591	9.5588619	22
39	2300433	3619038	9.3618095	9.5585932	21
40	2302290	3616799	9.3621599	9.5583244	20
41	2304147	3614560	9.3625100	9.5580554	19
42	2306004	3612322	9.3628601	9.5577864	18
43	2307863	3610084	9.3632099	9.5575173	17
44	2309722	3607847	9.3635597	9.5572481	16
45	2311582	3605610	9.3639092	9.5569787	15
46	2313442	3603374	9.364[illegible]586	9.5567093	14
47	2315303	3601138	9.3646078	9.5564397	13
48	2317165	3598903	9.3649569	9.5561701	12
49	2329027	3596668	9.3653057	9.5559004	11
50	2320890	3594434	9.3656546	9.5556306	10
51	2322754	3592201	9.3660031	9.5553606	9
52	2324618	3589968	9.3663516	9.5550906	8
53	2326483	3587736	9.3666998	9.5548204	7
54	2328348	3585504	9.3670480	9.5545502	6
55	2330215	3583272	9.3673959	9.5542798	5
56	2332082	3581041	9.3677437	9.5540094	4
57	2333949	3578811	9.3680913	9.5537388	3
58	2335817	3576581	9.3684389	9.5534681	2
59	2337686	3574352	9.3687861	9.5531973	1
60	2339556	3572124	9.3691334	9.5529265	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

50 DEGREES.

40 DEGREES.					
M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	2339556	3572124	9.3691334	9.5529265	60
1	2341426	3569896	9.3694803	9.5526555	59
2	2343296	3567669	9.3698272	9.5523845	58
3	2345168	3565442	9.3701739	9.5521132	57
4	2347040	3563215	9.3705205	9.5518420	56
5	2348913	3560989	9.3708668	9.5515706	55
6	2350786	3558764	9.3712111	9.5512992	54
7	2352660	3556539	9.3715591	9.5510275	53
8	2354535	3554315	9.3719051	9.5507559	52
9	2356410	3552091	9.3722508	9.5504840	51
10	2358286	3549868	9.3725964	9.5502122	50
11	2360162	3547645	9.3729418	9.5499401	49
12	2362040	3545423	9.3732872	9.5496681	48
13	2363918	3543201	9.3736323	9.5493958	47
14	2365796	3540980	9.3739773	9.5491236	46
15	2367675	3538760	9.3743221	9.5488511	45
16	2369555	3536540	9.3746668	9.5485786	44
17	2371436	3534321	9.3750113	9.5483059	43
18	2373317	3532102	9.3753557	9.5480333	42
19	2375198	3529884	9.3756998	9.5477604	41
20	2377081	3527667	9.3760440	9.5474875	40
21	2378964	3525450	9.3763878	9.5472144	39
22	2380848	3523234	9.3767316	9.5469413	38
23	2382732	3521018	9.3770751	9.5466680	37
24	2384617	3518802	9.3774186	9.5463947	36
25	2386503	3516587	9.3777618	9 5461212	35
26	2388389	3514372	9.3781050	9.5458477	34
27	2390276	3512158	9.3784479	9.5455740	33
28	2392163	3509945	9.3787908	9.5453002	32
29	2394051	3507732	9.3791334	9.5450263	31
30	2395940	3505520	9.3794760	9.5447524	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.
49 DEGREES.					

40 DEGREES.					
M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co Versed Sine.	
30	2395940	3505520	9.3794760	9.5447524	30
31	2397830	3503308	9.3798183	9.5444783	29
32	2399720	3501097	9.3801606	9.5442041	28
33	2401611	3498886	9.3805025	9.5439298	27
34	2403502	3496676	9.3808445	9.5436554	26
35	2405394	3494467	9.3811862	9.5433809	25
36	2407287	3492258	9.3815279	9.5431063	24
37	2409180	3490050	9.3818692	9.5428315	23
38	2411074	3487842	9.3822106	9.5425568	22
39	2412969	3485635	9.3825516	9.5422818	21
40	2414864	3483428	9.3828927	9.5420068	20
41	2416760	3481222	9.3832335	9.5417316	19
42	2418657	3479016	9.3835742	9.5414564	18
43	2420554	3476811	9.3839147	9.5411810	17
44	2422452	3474606	9.3842551	9.5409056	16
45	2424350	3472402	9.3845953	9.5406300	15
46	2426249	3470199	9.3849354	9.5403544	14
47	2428149	3467996	9.3852753	9.5400786	13
48	2430049	3465794	9 3856151	9.5398027	12
49	2431950	3463592	9 3859547	9.3395267	11
50	2433852	3461391	9.3862942	9.5392507	10
51	2435754	3459191	9.3866334	9.5389744	9
52	2437657	3456991	9.3869727	9.5386982	8
53	2439561	3454792	9.3873116	9.5384217	7
54	2441465	3452593	9.3876506	9.5381452	6
55	2443370	3450394	9.3879892	9.5378686	5
56	2445276	3448196	9.3883278	9.5375919	4
57	2447182	3445999	9.3886662	9.5373150	3
58	2449089	3443802	9.3890045	9.5370381	2
59	2450996	3441606	9.3893425	9.5367610	1
60	2452904	3439410	9.3896806	9.5364839	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm VersedS ine.	M.
49 DEGREES.					

41 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	2452904	3439410	9.3896806	9.5364839	60
1	2454813	3437215	9.3900183	9.5362066	59
2	2456722	3435021	9.3903561	9.5359293	58
3	2458632	3432827	9.3906935	9.5356518	57
4	2460543	3430633	9.3910309	9.5353742	56
5	2462454	2428440	9.3913681	9.5350965	55
6	2464366	3426247	9.3917052	9.5348187	54
7	2466279	3424055	9.3920421	9.5345408	53
8	2468192	3421864	9.3923789	9.5342628	52
9	2470106	3419674	9.3927155	9.5339846	51
10	2472020	3417484	9.3930520	9.5337065	50
11	2473935	3415295	9.3933882	9.5334281	49
12	2475851	3413106	9.3937245	9.5331497	48
13	2477767	3410918	9.3940604	9.5328711	47
14	2479684	3408730	9.3943964	9.5325925	46
15	2481602	3406542	9.3947310	9.5323137	45
16	2483520	3404355	9.3950677	9.5320349	44
17	2485439	3402169	9.3954031	9.5317558	43
18	2487359	3399984	9.3957384	9.5314768	42
19	2489279	3397799	9.3960735	9.5311975	41
20	2491200	3395614	9.3964085	9.5309183	40
21	2493121	3393430	9.3967433	9.5306388	39
22	2495043	3391247	9.3970781	9.5303593	38
23	2496966	3389064	9.3974125	9.5300797	37
24	2498889	3386882	9.3977470	9.5298000	36
25	2500813	3384700	9.3980812	9.5295201	35
26	2502738	3382519	9.3984154	9.5292402	34
27	2504663	3380339	9.3987493	9.5289601	33
28	2506589	3378159	9.3990831	9.5286799	32
29	2508516	3375979	9.3994167	9.5283996	31
30	2510443	3373800	9.3997503	9.5281195	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

48 DEGREES.

41 DEGREES.

M	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	2510443	3373800	9.3997503	9.5281193	30
31	2512371	3371621	9.4000836	9.5278387	29
32	2514299	3369443	9.4004169	9.5275581	28
33	2516228	3367266	9.4007499	9.5272774	27
34	2518158	3365089	9.4010829	9.5269966	26
35	2520088	3362913	9.4014157	9.5267156	25
36	2522019	3360737	9.4018484	9.5264346	24
37	2523951	3358562	9.4020808	9.5261534	23
38	2525883	3356388	9.4024132	9.5258722	22
39	2527816	3354214	9.4027453	9.5255908	21
40	2529749	3352041	9.4030775	9.5253094	20
41	2531683	3349868	9.4034093	9.5250277	19
42	2533618	3347696	9.4037412	9.5247461	18
43	2535554	3345524	9.4040727	9.5244642	17
44	2537490	3343353	9.4044043	9.5241823	16
45	2539426	3341183	9.4047355	9.5239002	15
46	2541364	3339013	9.4050668	9.5236182	14
47	2543301	3336844	9.4053978	9.5233358	13
48	2545240	3334675	9.4057287	9.5230535	12
49	2547179	3332507	9.4060594	9.5227710	11
50	2549119	3330339	9.4063001	9.5224885	10
51	2551059	3328172	9.4067205	9.5222057	9
52	2553000	3326006	9.4070509	9.5219230	8
53	2554942	3323840	9.4073810	9.5216400	7
54	2556885	3321674	9.4077111	9.5213570	6
55	2558827	3319509	9.4080409	9.5210739	5
56	2560771	3317345	9.4083708	9.5207907	4
57	2562715	3315182	9.4087003	9.5205073	3
58	2564660	3313019	9.4090298	9.5202239	2
59	2566606	3310856	9.4093591	9.5199402	1
60	2568552	3308694	9.4096883	9.5196566	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M

48 DEGREES.

42 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	2568552	3308694	9.4096883	9.5196566	60
1	2570498	3306532	9.4100173	9.5193727	59
2	2572446	3304371	9.4103462	9.5190889	58
3	2574394	3302211	9.4106749	9.5188048	57
4	2576342	3300051	9.4110036	9.5185207	55
5	2578292	3297892	9.4113320	9.5182364	56
6	2580242	3295733	9.4116603	9.5179521	54
7	2582193	3293573	9.4119885	9.5176676	53
8	2584143	3291418	9.4123166	9.5173830	52
9	2586095	3289261	9.4126444	9.5170984	51
10	2588047	3287105	9.4129722	9.5168136	50
11	2590000	3284949	9.4132998	9.5165286	49
12	2591954	3282794	9.4136273	9.5162436	48
13	2593908	3280639	9.4139546	9.5159585	47
14	2595863	3278485	9.4142818	9.5156732	46
15	2597819	3276332	9.4146088	9.5153879	45
16	2599775	3274179	9.4149357	9.5151024	44
17	2601732	3272027	9.4152625	9.5148168	43
18	2603689	3269875	9.4155891	9.5145311	42
19	2605647	3267724	9.4159155	9.5142453	41
20	2607606	3265573	9.4162419	9.5139594	40
21	2609565	3263423	9.4165681	9.5136733	39
22	2611525	3261274	9.4168941	9.5133872	38
23	2613485	3259125	9.4172199	9.5131009	37
24	2615447	3256976	9.4175458	9.5128146	36
25	2617408	3254828	9.4178715	9.5125280	35
26	2619371	3252681	9.4181970	9.5122415	34
27	2621334	3250535	9.4185223	9.5119547	33
28	2623297	3248389	9.4188475	9.5116679	32
29	2625262	3246243	9.4191726	9.5113810	31
30	2627227	3244098	9.4194975	9.5110939	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

47 DEGREES.

42 DEGREES.

M	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	2627227	3244098	9.4194975	9.5110939	30
31	2629192	3241954	9.4198223	9.5108068	29
32	2631158	3239810	9.4201470	9.5105195	28
33	2633125	3237667	9.4204714	9.5102321	27
34	2635092	3235524	9.4207958	9.5099446	26
35	2637060	3233382	9.4211201	9.5096569	25
36	2639029	3231240	9.4214442	9.5093692	24
37	2640998	3229099	9.4217681	9.5090813	23
38	2642968	3226959	9.4220919	9.5087934	22
39	2644939	3224819	9.4224156	9.5085053	21
40	2646910	3222680	9.4227391	9.5082172	20
41	2648882	3220541	9.4230625	9.5079288	19
42	2650854	3218403	9.4233858	9.5076404	18
43	2652827	3216266	9.4237089	9.5073519	17
44	2654801	3214129	9.4240319	9.5070633	16
45	2656775	3211993	9.4243547	9.5067745	15
46	2658750	3209857	9.4246774	9.5064856	14
47	2660725	3207722	9.4250000	9.5061966	13
48	2662701	3205587	9.4253224	9.5059075	12
49	2664678	3203453	9.4256447	9.5056183	11
50	2666655	3201319	9.4259669	9.5053290	10
51	2668633	3199187	9.4262889	9.5050395	9
52	2670612	3197054	9.4266108	9.5047500	8
53	2672591	3194922	9.4269325	9.5044603	7
54	2674571	3192791	9.4272541	9.5041705	6
55	2676551	3190661	9.4275755	9.5038806	5
56	2678533	3288531	9.4278969	9.5035906	4
57	2680514	3286401	9.4282181	9.5033005	3
58	2682497	3284272	9.4285391	9.5030102	2
59	2684479	3282144	9.4288600	9.5027198	1
60	2686463	3280016	9.4291808	9.5024293	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

47 DEGREES.

43 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	2686463	3180016	9.4291808	9.5024293	60
1	2688447	3177889	9.4295015	9.5021388	59
2	2690432	3175763	9.4298220	9.5018480	58
3	2692417	3173637	9.4301424	9.5015572	57
4	2694403	3171511	9.4304626	9.5012662	56
5	2696390	3169387	9.4307827	9.5009751	55
6	2698377	3167262	9.4311026	9.5006840	54
7	2700365	3165139	9.4314224	9.5003927	53
8	2702354	3163016	9.4317423	9.5001013	52
9	2704343	3160873	9.4320617	9.4998097	51
10	2706332	3158791	9.4323811	9.4995181	50
11	2708323	3156650	9.4327004	9.4992263	49
12	2710314	3154529	9.4330195	9.4989345	48
13	2712305	3152409	9.4333385	9.4986425	47
14	2714297	3150289	9.4336574	9.4983504	46
15	2716290	3148170	9.4339761	9.4980581	45
16	2718284	3146052	9.4342948	9.4977658	44
17	2720278	3143934	9.4346132	9.4974733	43
18	2722272	3141816	9.4349316	9.4971808	42
19	2724268	3139700	9.4352497	9.4968881	41
20	2726264	3137584	9.4355678	9.4965953	40
21	2728260	3135468	9.4358857	9.4963023	39
22	2730257	3133353	9.4362035	9.4960093	38
23	2732255	3131239	9.4365212	9.4957161	37
24	2734253	3129124	9.4368387	9.4954229	36
25	2736252	3127012	9.4371561	9.4951295	35
26	2738252	3124899	9.4374734	9.4948360	34
27	2740252	3122787	9.4377994	9.4945424	33
28	2742253	3120675	9.4381075	9.4942486	32
29	2744254	3118565	9.4384243	9.4939547	31
30	2746256	3116454	9.4387410	9.4936607	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

46 DEGREES.

43 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	2746256	3116454	9.4387411	9.4936607	30
31	2748259	3114345	9.4390576	9.4933666	29
32	2750262	3112236	9.4393741	9.4930724	28
33	2752266	3110127	9.4396904	9.4927780	27
34	2754271	3108019	9.4400066	9.4924836	26
35	2756276	3105911	9.4403226	9.4921890	25
36	2758281	3103805	9.4406385	9.4918944	24
37	2760288	3101698	9.4409543	9.4915995	23
38	2762295	3099593	9.4412700	9.4913046	22
39	2764302	3097488	9.4415855	9.4910095	21
40	2766310	3095383	9.4419009	9.4907144	20
41	2768319	3093279	9.4422161	9.4904191	19
42	2770329	3091176	9.4425313	9.4901237	18
43	2772339	3089073	9.4428462	9.4898281	17
44	2774349	3086971	9.4431611	9.4895325	16
45	2776360	3084869	9.4434758	9.4892361	15
46	2778372	3082768	9.4437904	9.4889409	14
47	2780385	3080608	9.4441048	9.4886448	13
48	2782398	3078568	9.4444192	9.4883488	12
49	2784411	3076469	9.4447334	9.4880525	11
50	2786426	3074370	9.4450474	9.4877562	10
51	2788441	3072272	9.4453614	9.4874597	9
52	2790456	3070175	9.4456752	9.4871631	8
53	2792472	3068078	9.4459888	9.4868663	7
54	2794488	3065982	9.4463024	9.4865696	6
55	2796506	3063886	9.4466157	9.4862726	5
56	2798524	3061791	9.4469290	9.4859755	4
57	2800543	3059696	9.4472422	9.4856783	3
58	2802562	3057602	9.4475552	9.4853810	2
59	2804582	3055509	9.4478680	9.4850835	1
60	2806602	3053416	9.4481808	9.4847860	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

46 DEGREES.

44 DEGREES.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
0	2806602	3053416	9.4481808	9.4847860	60
1	2808623	3051324	9.4484934	9.4844883	59
2	2810645	3049233	9.4488059	9.4841905	58
3	2812667	3047142	9.4491182	9.4838926	57
4	2814690	3045051	9.4494305	9.4835949	56
5	2816713	3042961	9.4497426	9.4832964	55
6	2818737	3040872	9.4500546	9.4829981	54
7	2820762	3038783	9.4503664	9.4826997	53
8	2822787	3036695	9.4506781	9.4824012	52
9	2824813	3034608	9.4509896	9.4821025	51
10	2826839	3032521	9.4513011	9.4818038	50
11	2828866	3030435	9.4516123	9.4815049	49
12	2830894	3028349	9.4519236	9.4812059	48
13	2832922	3026264	9.4522346	9.4809067	47
14	2834951	3024179	9.4525456	9.4806075	46
15	2836981	3022095	9.4528563	9.4803081	45
16	2839011	3020012	9.4531670	9.4800087	44
17	2841041	3017929	9.4534775	9.4797090	43
18	2843073	3015847	9.4537879	9.4794093	42
19	2845105	3013766	9.4540982	9.4791094	41
20	2847137	3011685	9.4544084	9.4788095	40
21	2849170	3009604	9.4547184	9.4785093	39
22	2851204	3007524	9.4550283	9.4782091	38
23	2853238	3005445	9.4553380	9.4779088	37
24	2855272	3003367	9.4556476	9.4776083	36
25	2857309	3001289	9.4559571	9.4773077	35
26	2859345	2999211	9.4562665	9.4770070	34
27	2861382	2997134	9.4565758	9.4767062	33
28	2863419	2995058	9.4568849	9.4764052	32
29	2865457	2992982	9.4571938	9.4761041	31
30	2867496	2990907	9.4575027	9.4758029	30
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

45 DEGREES.

44 DEGREE.

M.	Natural Versed Sine.	Natural Co-Versed Sine.	Logarithm Versed Sine.	Logarithm Co-Versed Sine.	
30	2867496	2990907	9.4575027	9.4758029	30
31	2869535	2988833	9.4578114	9.4755016	29
32	2871574	2986759	9.4581201	9.4752002	28
33	2873615	2984686	9.4584285	9.4748985	27
34	2875656	2982613	9.4587369	9.4745969	26
35	2877697	2980541	9.4590451	9.4742951	25
36	2879740	2978469	9.4593532	9.4739931	24
37	2881782	2976399	9.4596611	9.4736910	23
38	2883826	2974328	9.4599690	9.4733889	22
39	2885870	2972259	9.4602767	9.4730865	21
40	2887914	2970189	9.4605843	9.4727841	20
41	2889959	2968121	9.4608917	9.4724815	19
42	2892005	2966053	9.4611991	9.4721789	18
43	2894052	2963986	9.4615062	9.4718760	17
44	2896099	2961919	9.4618133	9.4715732	16
45	2898146	2959853	9.4621202	9.4712700	15
46	2900194	2957787	9.4624271	9.4709669	14
47	2902243	2955722	9.4627338	9.4706636	13
48	2904293	2953658	9.4630404	9.4703602	12
49	2906343	2951594	9.4633468	9.4700566	11
50	2908393	2949531	9.4636531	9.4697530	10
51	2910444	2947468	9.4639593	9.4694491	9
52	2912496	2945406	9.4642654	9.4691452	8
53	2914549	2943345	9.4645713	9.4688411	7
54	2916602	2941284	9.4648771	9.4685370	6
55	2918655	2939224	9.4651828	9.4682326	5
56	2920709	2937165	9.4654883	9.4679283	4
57	2922764	2935106	9.4657937	9.4676237	3
58	2924820	2933047	9.4660991	9.4673190	2
59	2926876	2930989	9.4664042	9.4670142	1
60	2928932	2928932	9.4667093	9.4667093	0
	Natural Co-Versed Sine.	Natural Versed Sine.	Logarithm Co-Versed Sine.	Logarithm Versed Sine.	M.

45 DEGREES.

THE USE OF THE FOREGOING TABLES.

THough I have all along the *Navigation* reference to these *Tables*, and sufficiently shewed the Use of the most of them, yet forasmuch as it may happen, this Part or Book to be alone, or strayed from its fellows by one chance or other, I have thought it convenient to add a sheet or two of its Use.

The Use of Table I.

I. The first is a *Table of Declinations* to 9 Degrees of Latitude from the Ecliptick, serving chiefly, by the *Longitude* and *Latitude* of the Moon or Planets to find the *Declination*; thus, Admit the Moon in 5° of *Sagittarius*, with 4° 30′ North Latitude: Looking for the Character ♐, in *page* 12, I find it over the left hand Column, and over head the Title *North Latitude*, then I look along on the top of the Table for 4° of Latitude, and follow that Column down till I come against 5° of the left Column under ♐, there I find 17° 17′; but seeing the Moon's given Latitude is not just 4 Degrees but 30 Minute more, I take the Parts proportional for that, and thence conclude the true Declination to be 16° 47′.

If the Longitude be between ♑ and ♋, you must look for the Sign at the lower Edge of the Page, and the Degrees of that Sign up along the right hand Column.

The Use of Table II. page 14.

II. The second is a *Table of Right Ascensions* to every Degree of the Ecliptick, and 9 Degrees of Latitude both North and South, and is to be

be entered with the *Longitude* and *Latitude*, in the very same manner as the former Table for *Declination* was, only here you'le find all the Signs on the top or upper part, without any bottom or reverse Enterings.

The Use of Table III. page 38.

III. The third is a *Table of Amplitudes* to 40 Degrees of Declination, and for all Latitudes to 61 Degrees, serving to find the *Distance* of the Sun or Star's Rising from the East, or Setting from the West; being of great use to rectifie the Compass by. Admit the Sun in 13° of ♌, and consequently having 17° Declination North, and I would find the Sun's Amplitude, or Distance of Rising from the East Point, in Latitude 52° 00', I look for the Latitude on the head of the Table, (which I find in Column the fourth, page 43) and for the Declination in the first Column to the left hand, under the Title *Degrees of Declination*, and in the common meeting I find 28° 21', the Amplitude, or Distance of Rising from the East, or Setting from the West, which is about 2 $\frac{1}{2}$ Points, so that the Sun doth then rise E N E $\frac{1}{2}$ Northerly, and set WNW $\frac{1}{2}$ Northerly, or NW by W $\frac{1}{2}$ Westerly.

Again, Admit the *Lion's Heart* have 13° 30' Declination North, and I require its Amplitude, or Distance of Rising from the East, in Latitude 35° 00' North: Turning to 35° of Latitude, and looking downwards thereunder 'till I come right against 13° of Declination, I find 15° 56', and for the 30' of Declination more I take the Proportional Parts 37', and add them to it, which makes 16° 33', the true Amplitude.

Note, That if the Sun or Star have North Declination, the Amplitude is North; and if the Declination be South, the Amplitude is South; that is, if the Sun or Star have North Declination, it will rise to the Northward of the East, and set to the Northward of the West, *&c.*

The Use of Table IV. page 44.

IV. The fourth is a *Table of Differences of Ascensions*, serving to find the *Time* of the Sun or Star's rising or setting in any Latitude; thus, first look the *Latitude* on the head of the Table, and the *Declination* down along the first Column towards the left hand under the Title *Degrees of Declination*, and in the common meeting is the Difference of Ascension in Degrees and Minutes, which being turned into Time by the following Table is (if it be for the Sun) the Time of his rising or setting before or after 6 of the Clock.

If the Declination be towards the elevated Pole, this is the Time of rising before, or his setting after 6; but if the Declination be towards the depressed Pole, it's the Time of rising after, and setting before 6 of the Clock.

Hence, if the Sun have Declination towards the elevated Pole, this Difference of Ascension in Time being subtracted from 6 Hours gives the Time of the Sun's rising, and being added gives the Time of setting; but if

if the Sun have Declination towards the depressed Pole, it's to be added to 6 Hours for the Time of rising, and subtracted from 6 for the Time of setting.

A Table to turn Degrees and Minutes into Time.

Deg.	*H.*	*M.*	*Deg.*	*H.*	*M.*	*Deg.*	*H.*	*M.*
$\frac{1}{4}$	0	01	8	0	32	18	1	12
$\frac{1}{2}$	0	02	9	0	36	19	1	16
$\frac{3}{4}$	0	03	10	0	40	20	1	20
1	0	04	11	0	44	30	2	00
2	0	08	12	0	48	40	2	40
3	0	12	13	0	52	50	3	20
4	0	16	14	0	56	60	4	00
5	0	20	15	1	00	70	4	40
6	0	24	16	1	04	80	5	20
7	0	28	17	1	08	90	6	00

Lastly, If you double the Time of Sun-rising, you have the Nocturnal Arch, or Length of the Night; and if you double the Time of Sun-setting, you have the Diurnal Arch, or Length of the Day.

Example.

July 25. the Sun having 17° of Declination North, I require the Time of Sun-rising and setting, and Length of the Day and Night, in Latitude 51° 00' North? I look along the Head of the Table till in page 57, in the second Column, I find the Latitude 51 Degrees, and running downwards 'till against 17 Degrees of Declination I find 22° 11', the Difference of Ascension; the 22 Degrees I look in the precedent little Table, and it gives 1 Hour 28 Minutes of Time, and for the 11' I take 1 Minute of Time, so that it is 1 Hour 29 Minutes. Now forasmuch as the Declination is towards the elevated Pole, I subtract 1^h 29' from 6^h, and the Remainder shews the Sun rises at 31 Minutes after 4 of the Clock; and adding it to 6^h, I find

°		h.	m.
20	=	1	20
2	=	0	08
		1	28

h.	m.	
6	00	
1	29	
4	31	the Sun's Rising.
6	00	
1	29	
7	29	the Sun's Setting.

the

the Time of setting to be 29 Minutes after 7 of the Clock. The double of 4 Hours 31 Minutes gives 9 Hours 2 Minutes, the Length of the Night; and the double of 7 Hours 29 Minutes gives 14 Hours 58 Minutes, the Length of the Day.

h.	m.		h.	m.	
4	31		7	29	
4	31		7	29	
9	02	the Length of the Night.	14	58	the Length of the Day.

The Use of Table V. page 59.

V. The fifth is a *Traverse-Table* to every Quarter-point of the Compass, and Hundred-part of a Mile or League Distance, and is to give the Difference of Latitude and Departure, thus; Look the Course, if under four Points from the Meridian, in the head of the Table, and the Miles failed down along the left Column, and in the common Angle of meeting under the Letters *E W* is the Departure from the Meridian; and under *NS* the Difference of Latitude: But if the Course be above four Points from the Meridian, look it at the bottom of the Table and the Distance failed, look upwards in the right hand Column, and in the common Angle of meeting over the Letters *E W* at the bottom will be the Departure, and over the Letters *NS* the Difference of Latitude in failing this Course and Distance. If the Distance be above 60, it must be broken into several Numbers, and therewith the Table entred, and the Departure and Difference of Latitudes taken out proper to each part of the Distance, the Totals or Aggregates of these will be the Difference of Latitude and Departure required.

Example 1.

Admit a Ship fail 31 Leagues South South West, that is, two Points from the Meridian, and it be required to find the Difference of Latitude and Departure.

Because the Points are less than 4 look them on the head of the Table, and right against 31 in the left hand Column under *Dist. in Leagues or Miles failed*, is under *E W* 11.86 the Leagues departed from the Meridian, and under *NS* 28.64 the Leagues Difference of Latitude fought.

Example 2.

Admit a Ship fail 25 Miles West by South one quarter Point Westerly, that is, $7\frac{1}{4}$ Points from the South, and it be required to find the Difference of Latitude and Departure.

Look the $7\frac{1}{4}$ Points (because above 4) at the bottom of the Table, which you'l find in the 59th. page, and over $7\frac{1}{4}$ Points and right against 25 the Miles failed, you have 24.73 the Miles Departure, and 3.66 the Miles Difference of Latitude. If the Distance had been in Leagues, the Departure had been 24.73 Leagues, and the Difference of Latitude 3.66 Leagues.

Example 3.

Suppose a Ship fail 276 Miles North East by North, that is, 3 Points from the North, and it be required to find how much she has altered her Latitude, and also how much she's Departed from the Meridian.

Over 3 Point right against 200 Miles Distance, you'l find under the Letters *N, S,* 166.28 Miles Difference of Latitude; and under *E, W,* 111.11 Miles Departure; Secondly under 3 Points and right against 70 Miles Distance you'l find under *N, S,* 58.22 Miles Difference of Latitude, and under *E, W,* 38.88 Miles Departure; and Thirdly, under 3 Points and against 6 Miles Distance you'l find under *N, S,* 4.99 Miles Difference of Latitude, and under *E, W,* 3.33 Miles Departure.

Dist.	*Diff. Lat.*	*Dep.*
200	166.28	111.11
70	58.22	38.88
6	4.99	3.33
276	229.49	153.32

So that the Difference of Latitude for the whole Distance 276 Miles, is 229.49 Miles, and the Departure 153.32 Miles.

Example 4.

Suppose a Ship fail East North East half a Point East 134 Miles, and it be required to find the Difference of Latitude and Departure.

Dist.	*Diff. Lat.*	*Dep.*
100	29.02	95.69
34	9.87	32.54
	38.89	128.23

The Difference of Latitude for the whole Distance is 38.89 Miles, and the Departure 128.23 Miles.

The Use of Table VI. page 68.

VI. The sixth is a *Table of Meridional Miles or Parts*, to every Degree and Minute of Latitude, serving to make a *Mercator's* Chart, or work the *Mercator*-sailing, and is to be entred with the Degrees of Latitude on the head, and the Minute down the left hand Column. Having the Latitudes of two Places, to find the Meridional Miles or Minutes between them, consider whether the Places be one under the Equinoctial and the other wide thereof, or the one on the one side of the Equinoctial and the other on the other, or whether they both lye on the same side; for according to these Positions, there's a threefold Case.

1. When one Place lyeth under the Equinoctial, then the Meridional Minutes that are found next under the Degree of Latitude the other Place lyeth in, is the Meridional Difference of Latitude, or Latitude inlarged.

2. When one Place hath North Latitude, and the other South, add the Meridional Minutes belonging to each Latitude together, and the Sum is the Meridional Minutes between them.

3. When both Places are towards one Pole, then subtract the Meridional Parts answering to the lesser Latitude out of those for the greater, and the Remainder will be the Meridional Minutes required.

Examples of these Cases will make them more plain, which shall be these:

Example 1.

To find the Meridional parts or Minutes, between the Equinoctial and Latitude 43° 11′.

In the Column under 43, and right against 11 Minutes in the Left-hand Column stands 2878.2, the Meridional parts required.

Example 2.

Let it be required to find the Meridional parts between 25° 13′ South Latitude, and 51° 30′ North.

Under 51° and against 30′ is	3616.8
Under 25° and against 13′ is	1564.3
The Meridional parts between the two are	5181.1

Example 3.

To find the Meridional Minutes between the Latitudes 32° 15′ North, and 53° 23′ North.

Under 53° and against 23′ is	3802.2
Under 32° and against 15′ is	2046.1
The Meridional parts between the Latitudes proposed, are	1756.1

VII. The

The Use of Table VII. page 94.

VII. The seventh is a *Table of the Miles East or West, that Answer to the Degrees of Longitude in the fourth Rumb:* and serves to turn Miles of Easting or Westing into Degrees and Minutes of Longitude, *& contr.* As, Admit a Ship sail from the Equator on some Point between the North and East to 10° Latitude, and then finds she has made 400m Departure East; to find the Degrees of Longitude answering to this 400 Miles, turn to the Table page 94, and look for 10° Latitude, and right against it you'l find 600 Miles, the Miles East the Ship would have been if she had sailed on the fourth Rumb: Then say by the Golden Rule, *As* 600 Miles *is to* 10° 3′ *so is* 400 Miles, and multiplying and dividing you will produce 402, which divided by 60 gives 6° 42′ the Degrees of Longitude answering to the 400 Miles Easting.

$$\begin{array}{l}
\text{m.} \quad {}^{\circ}\ {}' \quad \text{m.} \\
600 : 10\ 3 :: 400 \\
\quad\quad 60 \\
\hline
\quad 603 \\
\quad\quad 400 \\
\hline
600)\ 241200\ (402 \\
\quad\quad 2400 \\
\hline
\quad\quad 1200 \\
\quad\quad 1200 \\
\hline
\quad\quad\quad 0
\end{array}
\qquad
\begin{array}{l}
60)\ 402\ (6^{\circ}\ 42' \\
\quad\ \ 360 \\
\hline
\quad\quad 42
\end{array}$$

On the contrary, if one knowing the Difference of Longitude made, as here 6° 42′, would find the Miles East or West answering thereto, look in the said Table against the Latitude, *viz.* 10°, and take out the Miles against it and also the Degrees and Minutes, and say: *As* 10° 3′ *is to* 600 *so is* 6° 42′, which worked as before produces 400 Miles, thus:

$$\begin{array}{l}
{}^{\circ}\ {}' \quad \text{m.} \quad {}^{\circ}\ {}' \\
10\ 3 . 600 :: 6\ 42 \\
\ \ 60 \quad\quad\quad\quad 60 \\
\hline
603 \quad\quad\quad\ 402 \\
\quad\quad\quad\quad\quad\quad 600 \\
\hline
603)\ 241200\ (400\ \text{m.}
\end{array}$$

Admit

Admit a Ship sail from Latitude 6° *N*, to 16 North, and hath made 400 Miles Departure East, to find the Degrees of Longitude she has altered; take out of the Table the Numbers against 6°, which are 360 Miles and 6°, and also those against 16° which are 960 Miles and 16° 12′, and subtract them one from the other, then say: *As* 600, *to* 10° 12′; *so* 400; and it will produce 6° 48′, thus:

m.	° ′	° ′	
960	16 12	600 . 10 12 :: 400	
360	6 00	60	
600	10 12	612	
		400	
		600) 244800 (408	60) 408 (6° 48
		2400	36
		4800	48
		4800	
		0	

By the reverse of this you may having the Difference of Longitude given, find the Miles East or West Departure.

The Use of Table VIII. page 100.

VIII. The eighth is a *Table to Change Degrees and Minutes of any Parallel into Miles,* thus: Look the Latitude in the Left-hand Column, and the Degrees and Minutes of Longitude on the head of the Table, and right against the Latitude and under the Degree of Longitude you will have the Miles and parts sought.

If the Longitude given consists of Degrees and Minutes, look the Miles and parts answering the Degrees first, and then those for the Minutes, and if either the Degrees or Minutes be above 10, you must enter several times. As you will see by these Examples.

Example 1.

Admit I have altered 3° 15′ of Longitude, under the Parallel of 50° Latitude, and it be required to find the Miles and parts answering thereto.

I enter the Table as directed with	3 Degrees which gives	115.7 Miles.
	10 Minutes which gives	006.4
	5 Minutes which gives	003.2
		125.3 Miles.

Example 2.

Example 2.

To find the Miles answering to 25° 32′, in the Parallel of 46° of Latitude.

20 Degrees gives . .	833.6 Miles.
5 Degrees gives . .	208.4
30 Minutes gives . .	020.8
2 Minutes gives . .	001.4
	1064.2 Miles.

The Use of Table IX. page 108.

IX. The ninth is a *Table to Reduce Miles East and West into Degrees of Longitude*, it is to be entred with the Miles on the head and the Degrees of Latitude in the Left-hand Column.

Admit a Ship sail 157 Miles East or West in the Parallel of 53°, and its demanded how many Degrees of Longitude are altered.

	°	′	″
100 Miles gives . . .	02	46	15
50 Miles gives . . .	01	23	05
7 Miles gives . . .	00	11	38
The Sum	04	20	58

The Use of Table X. page 120.

X. The tenth is a *Table of Rumbs with the Differences of Longitudes and Latitudes.*

Prop. 1.

The Latitudes of two places and their Difference of Longitude being given to find the Course and Distance.

Suppose a Ship set from Latitude 51° 8′ North, and sail on some Rumb between the South and East till she fall in Latitude 28° 30′ North, and have altered her Longitude 19° 20′; what Course has she kept and what Distance has she run? I seek under the fourth Rumb in this Table against Latitude 28° 30′ and find the Longitude answering thereto 29° 46′, and against 51° 8′, 59° 46′; the Difference of these two Longitudes 59° 46′ and 29° 46′, is 30° which should be but 19° 20′, therefore the fourth was not the Rumb: Again, against these Latitudes I take out the Longitude answering to the third Rumb, and find them to differ but 19° 58′ which being only a few Minutes over the true Difference of Longitude 19° 20′, I conclude her to have sailed on the third Rumb.

To

To find the Distance, subtract the given Latitudes one from the other, and the Difference 22° 38', look in the Left-hand Column of the Table, under Title Latitude, and under the third Rumb you'l find 1634 Miles of 60 to a Degree, the Distance required.

If the Latitudes had been the one North and the other South, you must have added them and taken the Sum for the Difference.

Prop. 2.

The Course and Distance being given, with the Latitude Departed from, to find the Latitude she's in and the Difference of Longitude.

A Ship failing from 10° North Latitude North East 1317 Miles, what is the Latitude she's in and her Difference of Longitude? Looking under the fourth Rumb for the Distance 1317, I find 1315 the nearest to it, and right against it 15° 30', but making a proportionable allowance for the two Miles Difference, the Latitude is 15° 25' to which add the Latitude 10°, you have 25° 25' the Latitude she's arrived in; Lastly, against these Latitudes and under the Rumb look the correspponding Longitudes, which are 10° 3' and 26° 17', and their Difference 16° 14' is the true Difference of Longitude.

Prop. 3.

Both the Latitudes and the Course being given, to find the Distance failed and the Difference of Longitude.

A Ship sails from the Grand *Canarie*, in Latitude 28°, North East till she be in Latitude 36° 30' North, her Distance failed and Difference of Longitude is required?

Against Latitude 28° and under the fourth Rumb, you'l find the Longitude to be 29° 11', and against the Latitude 36° 30', and under the same Rumb you'l find 39° 15', then from 39° 15' subtract 29° 11', the remainder 10° 4' is the Difference of Longitude required.

Secondly, take the Latitudes one from the other and look the remainder 8° 30' under the Title Latitude in the Left-Column, and under Rumb the fourth you'l have 72 Miles the Distance.

Prop. 4.

The Latitudes of two places and the Distance being given, to find the Course and Difference of Longitude.

A Ship sails from Latitude 20° North 4200 Miles, and then arrives in Latitude 46° 50', what Course has she steered and what is the Difference of Longitude?

Look the Difference of Latitude 26° 50' under Latitude, and right against it searching under all the Rumbs for the Distance 4200 Miles at length, I find it nearly under the sixth Rumb, the Rumb failed on.

	°	'	
Then against Latitude 46° 50' under the sixth Rumb is	128	18	Long.
Against 20° Latitude under the sixth Rumb is . .	49	18	Long.
Remains the Difference of Longitude	79	00	

Prop. 5.

The Difference of Longitude, Distance, and one Latitude being given, to find the other Latitude and the Course.

Take the Rumb which you judg fittest, and examin what Difference of Latitude will answer to the Distance given, with which Latitude search all the Rumbs for a Difference of Longitude like that given, and where you find it, that is the Rumb sought.

Admit a Ship sail from Latitude 14° North, till she alter her Longitude 10° 36' and make her Distance failed 849 Miles.

I choose the fourth Rumb and search under it till I find 849, it's against 10° Latitude, which added to 14° gives 24° the second Latitude; the Longitudes that answer to these Latitudes under the fourth Rumb are 14° 8' and 24° 44', whose Difference is 10° 36', just agreeing to my Difference of Longitude given; whence I conclude the fourth Rumb to be that failed on.

Prop. 6.

The Difference of Longitude, Course, and one Latitude being given, to find the other Latitude and the Distance.

Suppose a Ship sail from Latitude 30° North, on the fifth Rumb, till she vary her Longitude 34°; to find the other Latitude and Distance.

Look under the fifth Rumb for the Longitude answering to 30° Latitude, and you'l find 47° 6', to which add 34° the Difference of Longitude given, and see for the Sum 81° 6' under the same Rumb under the Title Longitude, and you will find 47° 35' the other Latitude.

To find the Distance, subtract the Distance answering to Latitude 30° from the Distance answering 47° 35', and the Difference 1896 Miles is the Distance required.

If the Latitudes at any time be the one North, and the other South, add them for the Difference.

The Use of Table XI. page 1.

XI. The eleventh is a *Table of Logarithms*, whose use is explained in the *Cosmography*.

The Use of Table XII. page 47.

XII. The twelfth is a *Table of Proportional parts*, which makes the *Table of Logarithms* serve to 1000000, thus,

When you have found the *Logarithm* for five places by the direction in the *Cosmography*, then enter this Table of proportional parts, again, with the Difference of the Differences, and you will find a small number to be added to that *Logarithm* to make it serve the sixth place.

Let it be required to take out the *Logarithm* of 382574, first I look in the Left Column of the *Logarithm* Tables for 382, and right against it under 5 I take out 5826314, and the Difference 1135, which Difference I look in the Left Column of the Table of proportional parts, and under 7 I find 680 to be added to 5826314, which makes 5826994 the *Logarithm* of 38257; Lastly subtract 680 from the next Difference right against it *viz.* 793 and seek the Difference 113 in the Left Column of the Table of proportional parts, and against it under 4 I find 46 which I add to 5826994 and it makes 5827040, to which I annex 5 for the Index, and the whole number 5,5827040 is the true *Logarithm* of the natural number 382574. Let the *Logarithm* of the Natural number 130846 be required; First I look the three first Figures 130 in the Left Column of the *Logarithm* Tables, and against it vnder 8 I find 1166077 the *Logarithm* of 1308, and 3329 the Difference, with which entring the Table of proportional parts, under 4 I find 1332 which added to 1166077, makes 1167409; then I subtract 1332 from the next Difference 1665, and see for the remainder 333 in the said Table of proportional parts, and against it and under 6 I find 199, which added to 1167409 makes 1167608, to which last of all I prefix the Index 5, and have the Compleat *Logarithm* 5, 1167608 for the given number 130846.

The Use of Table XIII. page 71.

XIII. The thirteenth is a *Table of Natural and Artificial Sines, Tangents and Secants*, to every Minute of the Quadrant.

To take out the Sine, Tangent, or Secant, either Natural or Logarithmical, of any Degrees and Minutes.

If it be the Natural Sine, Tangent, or Secant, that's required, look on the Left-hand pages, but if the Logarithmical on the Right.

If

If the Degrees be less than 45 look it on the Head of the Table, and the Minutes down the left Column under M: but if the Degrees be above 45 look it at the bottom or foot of the Table, and look the Minutes upward in the Right-hand Column, and in the Column distinguisht by the Title, *Sine*, *Tangent*, or *Secant*, or *Co-sine*, *Co-tangent*, or *Co-secant* at the bottom or top, according as the Degree is, right against the Minute you have the *Sine*, *Tangent*, *Secant*, or *Co-sine* required.

As suppose you were to find the Natural sine, tangent and secant of 23° 13′. Look on the left-hand pages, page after page for 23° on the head of the Table, and down the left hand Column under M for 13′: then right against 13′ under the words *Natural sine* in the head of the Table you shall have 3942093, which is the *Natural sine* of 23° 13′, against 13′ under *Natural tangent*, you have 4289449 the Natural tangent of 23° 13′, and against 13′, and under the Title (*Natural secant*) you have 10881148 the Natural secant of 23° 13′.

If you would have also the artificial or Logarithmical sine, tangent and secant thereof, look on the Right-hand page having 23 Degree at the head, and run down along its left Column to 13′, then right against 13′, and under (*L. sine*) you have 9,5957268 the Logar. sine of 23° 13′, against 13′, and under (*L. Tang.*) you have 9,6324015, the artificial or Logarithmical Tangent of 23° 13′, and against 13°, and under (*L. secant*) you have 10,0366747 the Log. secant of 23° 13′.

Suppose you were to find the Natural Sine, Tangent and Secant of 32° 48′. Look 32 Degree at the Head of the Table on the left page, and forasmuch as there's two leaves marked 32 turn to the latter, (because the minutes exceed 30,) and run down the left Column under M to 48′, then right against 48′, and under (*Nat. Sine*) you will find 5417082 the Natural Sine of 32° 48′, against 48′ and under (*Nat. Tangent*) you will have 6444560 the Natural Tangent, and right against 48′, and under (*Nat Secant*) you may take out 11896737 the Natural Secant of 32° 48′. If you would have the Artificial or Logarithmical sine, Tangent and Secant thereof also, look on the Right-hand page having 32 Degrees at the head, and run down along it's left Column to 48′, then right against 48′, and under (*L. sine*) you will have 9,7337654 the Logarith. sine of 32° 48′, against 48′ and under (*L. Tangent*) you will find 9,8091933 the Logarithmical Tangent of 32° 48′, and right against 48′, and under (*L. Secant*) you will see 10,0754279 the Logarithmical Secant of 32° 48′.

Admit you were to find both the Natural and Artifical Sine, Tangent and Secant of 61° 25′. Now because the Degrees are above 45, turn to 61 Degree at the bottom, and look upwards in the Right Column of the Right-hand page to 25′, and right against 25′, and over (*L. Sine*) you have 9,9435549 the Logar. Sine of 61° 25′, right against 25, and over (*L. Tangent*) is 10,2637307 the Logar. Tangent of 61° 25′, and right against 25′, and over (*L. Secant*) is 10,3201757 the Logar. Secant of 61° 25′, Also on the Left-hand page right-against 25′, in the Right-hand Column and over (*Nat. Sine*) is 8731222 the Natural Sine of 61° 25′,

 right

right againſt 25′, and over (*Nat. Tangent*) is 18353999 the Natural Tangent of 61° 25′, and right againſt 25′, and over (*Nat. Secant*) is 20901418 the Natural Secant of 61° 25′, and againſt 25′ and over (*Nat. Co-ſecant*) is 11387937 the Natural Co-ſecant, or Secant Complement of 61° 25′, &c.

To find the Sine, Tangent, or Secant, either Natural or Artificial, of any Degrees and Minutes exceeding 90 Degrees but under 180: ſubtract them from 180, and look the Sine, Tangent, or Secant of the Remainder as before directed. So the Natural Sine of 123° 11′ is 8369235, the Natural Tangent 15291308 the Natural Secant 18270854, the Logar. ſine 9,9226858 the Logar. Tangent 10,1844446, the Logar. Secant 10,2617588, and the Logar. Co-ſecant 10,0773142.

180	00
123	11
56	49

To take out the Sine, Tangent, or Secant, either Natural or Artificial of any Degrees and Minutes above 180 Degrees but under 270, ſubtract 180 there from, and look the Sine, Tangent, and Secant of the reſt as above directed, and that ſhall be the Sine, Tangent, or Secant of the Arch propoſed, ſo the Natural Sine of 231° 54′ is 7869350, the Natural Co-ſine 6170359, the Natural Tangent 12753473, the Natural Co-tangent 7841002, the Natural Secant 16206513, the Natural Co-ſecant 12707529, the Logar. Sine 9,8959389, the Logar. Co-ſine 9,7903104, the Logar. Tangent 10,1056285, the Logar. Co-tangent 9,8943715, the Logar. Secant 10,2096896, the Logar. Co-ſecant 10,1040611.

231°	54′
180	00
51	54

To find the Sine, Co-ſine, Tangent, Co-tangent, Secant or Co-ſecant, either Natural or Artificial of any Arch above 270 Degrees, and under a Circle or 360°, ſubtract it from 360, and look the Sine, Co-ſine, Tangent, or Secant, &c. Of the reſt according to the foregoing Directions; and that ſhall be the Sine, Tangent, or Secant, &c. of the Arch propoſed.

Having the Sine, Tangent, or Secant, either Natural or Artificial, to find the Degrees and Minutes anſwering thereto.

If it be a Natural Sine leſs than	7071068
A Natural Tangent leſs than	10000000
Or a Natural Secant leſs than	14142136

Look for it on the Left-hand pages under the Titles *Natural Sine, Natural Tangent, Natural Secant*, on the head of the Table, elſe look for it over thoſe Titles which are at the bottom.

If it be a Logar. Sine leſs than	9,8494850
A Logar. Tangent leſs than	10,0000000
Or a Logar. Secant leſs than	10,1505150

Look

Look for it on the Right-hand page under the Title *L. Sine, L. Tangent, L. Secant*, but if it be greater than theſe, then the Degree is above 45, and you muſt look for it on the Right-hand page over the Title *L. Sine, L. Tangent*, &c. which are at the bottom.

Suppoſe you were to find the Degrees and Minutes anſwering to this Natural Sine 7027782, this being leſs than 7071068, I run over the Columns of Sines on the Left-hand pages, looking under the Title (*Nat. Sine*) at the top, page after page, for 7027782, and under 44 Degrees, and againſt 39′ in the Column under M, I find 7027741, which is the neareſt to the Sine ſought, and the Arch anſwering thereto is 44° 39′.

Let it be required to find the Degrees and Minutes correſponding to this Natural Sine 8672501, this being greater than 7071068, I run over the Columns of Sines on the Left pages looking over the Title (*Nat. Sine*) at the bottom, and over 60 Degrees and againſt 8′, which is over M in the Right-hand Column, is the neareſt thereto, ſo that the Arch is 60° 8′.

After this manner will the Arch anſwering to the Natural Tangent 17250936 be 59° 54′, the Arch to the Natural Secant 10002194 be 88° 48′, the Arch to the Logar. Sine 8,8647376 be 4° 12′, the Arch to the Logar. Tangent 10,347349[illegible] be 65° 48′, and the Arch to the Logar. Secant 10,0503124 be 27° 03′.

The Uſe of Table XIV. page 72.

XIV. The fourteenth being a ſmall Table inſerted under the Sines, Tangents, and Secants, *is a Table to find the hour of the day*, in all Latitudes under 60°, by the bearing of the Sun; thus,

Turn to the Latitude, and under it in the upper Collumn or head Rank ſeek the Declination, and the point of the Compaſs that the Sun is upon in the left Collumn, and in the common place of meeting will be the time of day required. *Example.*

June 10th 1678, Being in Latitude 46° 00′ N, and the Sun SSW, I require the time of day?

Looking againſt two Points under 23° ½ Declination N, (the Suns Declination at that time) I find the time to be 39′ after twelve.

Admit the Sun N E by N in the Latitude 51° 00′ N, and the Declination 14° South: to find the time of day?

I turn to 51° Latitude, and againſt three Points under 14° Declination S, I find 2^h 12′, which I ſubtract from 12 the Remainder 9^h 48′; ſhews it was 48′ after 9 in the Morning.

In the Latitude 30° N, the Sun having 15° 00′ N Declination, its deſired to know at what a Clock the Sun will come upon the SW point of the Compaſs?

I look in the Declination Collumn for 15° but not finding it, I look down along under the next neareſt, *viz.* Under 14° 'till I come againſt

Aaa 2 four

four Points in the left Collumn and there I find 1^h 2′: and against it under *d* for Difference is 7′, the half whereof is 3′, which being taken from 1^h 2′, leaves 59 afternoon the true time.

If the Latitude be South, you must take North declination for South, and South for North.

Admit the Declination be 12° North, I desire to know at what a Clock the Sun will come upon the W S W point of the Compass, in Latitude 30° South?

When I have found the Latitude, I look in that Part under Title South Declination, and under 12° against 6 Points, I find 27′ after 4 in the afternoon, the true time of day.

By this Table also may be found the true hour of the Night, by the bearing of any known Star; whose Declination doth not exceed the Suns greatest Declination; Thus,

First, Find the time of the Stars coming to the Meridian on the day proposed, then if the Star be on the East side of the Meridian, you must subtract those hours and minutes which the Table shews the Star to be distant from the Meridian, from the time of the Stars coming to the Meridian: and the remainder is the true hour of the night, but if the Star be on the west side of the Meridian, then you must add those hours and minutes abovesaid, to the time of the Stars coming to the Meridian as abovesaid, and the Sum is the true hour of the Night.

September 12th being in Latitude 43° North, I observe the Bulls eye to be upon the S E point of the Compass: I require the hour of the Night?

The time of this Stars being on the Meridian	16^h	20′
It's distance from the Meridian either at S E *or* S W . . .	1	38
The time of the Stars being S E	14	42
The time of the Stars being S W	17	58

January 7th $168\frac{3}{4}$, Being in Lattitude 48° N, I see the *Scorpions* heart upon the E S E point: what is the time of the Night? The Stars Declination is 16°.

The time of this Stars being on the Meridian	20^h	11′
It's distance from the Meridian	3	11
The time of the Night	23	22

If the Compass hath Variation, you must allow for the Variation.

Lastly,

Lastly, By this Table having the Suns Declination, Latitude of the place, and hour of the Day, you may find the point of the Compass the Sun's upon; Thus,

Look the Latitude, and in the Declination Collumn the Declination, and down along under the Declination, seek for the hour given; then right against that in the left Collumn you'l have the point the Sun's upon.

Example 1.

In Latitude 52° 00′ North, the Sun having 10° South Declination, it's required to know on what point of the Compass it will be at three of the Clock in the afternoon?

At Latitude 52°, under 10° South Declination: I look for 3^h, but not finding that, I take the next I can find to it, which is 2^h 53′, and in the left-hand Collumn right against it, is 4 points, which is S W.

Example 2.

In Latitude 58° North, the Sun having 16° North Declination, it's required to know on what point of the Compass he will be at 8 hours before noon, or 4 of the Clock in the Morning?

At Latitude 58° North, under 16° North Declination: I look for 8 hours: but not finding that, I take the next to it, *viz.* 8^h 2′, and in the left Collumn right against it is three points, from the East Northward, that is N E by E.

The Use of Table XV. page 194.

XV. The fifteenth Table beginning under 30° of the Sines, Tangents, and Secants, is a *Table of the points of the Compass, the Sun Rises or sets on*, in all Latitudes to 60°.

Look the Latitude on the head of the Table, and down along under it for the Declination, against which in the left Collumn you'l have the point of the Compass the Sun Rises and Sets with, and consequently the Variation of the Compass.

Example 1.

Suppose I being in Latitude 32° North, and the Sun having 9° 30′ Declination North, observe the Sun to rise by the Compass E N E, I demand the true point the Sun should rise on, and consequently whether my Compass have any Variation, and if any how much.

I look

I look in this Table on the head for the Latitude, and under that for 9° 30′ Declination: and against it I find one point, which is to the Northward of the East, because the Declination is North, so that the true point of rising is E by N, and of setting W by N: but by the Compass it's E N E, between these two are one point difference, which is the Variation. If I were to observe the Sun setting by the Compass, I should find him set due West by it, forasmuch as one point added to the West by North gives West.

Example 2.

Being in Latitude 44° North, and the Suns Declination 10° North, I observe the Sun to rise upon the E by N point of the Compass: I demand the Variation?

Looking in the Table as directed, I find $1\frac{1}{4}$ points from the East Northward to be the point of rising, which is E by N $\frac{1}{4}$ Nly, but by the Compass it's just E by N, therefore I conclude a point Variation.

Example 3.

Being in Latitude 53°, and the Suns Declination being 15° South, I find the Sun Rise upon the E by N point of the Compass. I demand the Variation? By the Tables the Sun should rise E S E $\frac{1}{4}$ Sly, therefore there's $1\frac{1}{4}$ Variation. Where you cannot find the Declination exact take the next nearest.

The Use of Table XVI. page 201.

XVI. The sixteenth beginning under the 32° of the Sines, Tangents, and Secants, is *a Table of the Latitudes and Longitudes of places*, the Longitude beginning at the Meridian of the *Lizard*, and increasing both ways, that is both East and West, and terminating at 180°, whence all places that lye on the East side of the Meridian of the *Lizard* lye in East Longitude: and on the contrary, all those places that lye on the West side of the Meridian of the *Lizard*, lye in West Longitude.

If a Ship be in East Longitude, and Sail Eastward, she increaseth her Longitude, but Sailing to the Westward, she decreaseth her Longitude. On the contrary, if a Ship be in West Longitude then Sailing to the Westward the Longitude increaseth, and Sailing to the Eastward it decreaseth.

Note also that to all those places that lye in East Longitude, the Sun comes to their Meridian before he comes to our *Lizard* Meridian. And to all the places that have West Longitude, the Sun or Star comes to their Meridian, after he is past the *Lizard* Meridian.

To

To find the Difference of Longitude between any two places, if they have both East or both West Longitude, subtract the lesser Longitude from the greater, and the Remainder is it: but if one place be in East, and the other in West Longitude, add, and the sum is the difference of Longitude.

This Table though very well designed in making the Longitude begin from the Meridian of the *Lizard*, which being nearly the same with that of *Ushent* is the most convenient for all *English*, *French*, *Dutch*, *Danes*, &c. that Sail out at and come into our Channel that can be, yet to prevent others verdict I must acknowledg the Longitudes and Latitudes of the places therein not to be so true as they ought to be. But 'tis hoped the truth and goodness of the other Tables in this Vollumn will pretty well compensate the badness of this.

The Use of Table XVII. page 253.

XVII. The seventeenth is a *Table of the Suns Declination*. To find the Declination thereby, look the year and month in the head of the Table, and the day of the month in the Left-hand Collumn of the Table, and in the Angle of meeting you'l have the Declination you seek for: as,

Suppose the Suns Declination be required on the twenty fifth of *July*, 1681.

In the head of the Table I find the year and month, and in the left-hand Collumn of the Table, the Day, and in the common Angle of meeting is 17° 8′, the Declination required.

But if you be far East or West from the Meridian of *London*, for which these Tables were computed, you must allow for it, making the Declination somewhat greater or less than what it is in the Tables; for if you be to the Westward, the Sun coming to your Meridian after it has passed the Meridian of *London*, for which the Tables are made, the Declination will be somewhat increased, and if you be to the Eastward, it will be diminished, thus by the small Table for this purpose.

Admit *April* 20*th*, 1679. I be in 118° East Longitude, what will be the Suns true Declination on that day in that Latitude?

The Declination for the 20*th* of *April* in the Meridian of *London* is 14° 52′, and the dayly difference at that time is 19′, therefore in this Table, I look in the head thereof for the nearest number to 19′, which is 18, then I look on the left-hand of the Table for 118, but not finding that I take the next, *viz.* 120°, and look against it 'till under 18′, and there I find 6′, which I subtract from the Declination in the Meridian of *London* 14° 52′, and the remainder 14° 46′, is the true Declination for that Meridian or Longitude I am in. But if the Declination had decreased, which is easily discerned, by observing whether the Declination for the Day following be greater or lesser than that given, then you must have added.

The

The Declination in the Meridian of London	14°	52′ N,
The proportional Minutes Subtract	0	06
The Declination for the Longitude 118° East	14	46
The Declination for the Longitude 118° West	14	58

To take away all doubt in this business remember these Rules.

1. If the Longitude be Easterly, and the Declination increase, the proportional parts abovementioned, must be subtracted, but the Declination decreasing it must be added.

2. If the Longitude be Westerly, and the Declination increasing, the proportional Minutes must be added to the Declination found, but if the Declination be decreasing, you must subtract.

July 25*th*, 1679. Being 75° Longitude West, I require the Suns true Declination at noon that day in the said Meridian from *London.*

The Declination at London	17°	16′ N,
The proportional Minutes		03
The Declination in Longitude 75° East	17	19
The Declination in Longitude 75 West	17	13

The Use of Table XVIII, page 258.

XVIII. The eighteenth is a *Table of the Suns Right ascension*, to be entred just as that of the Suns Declination was, by looking the month on the head of the Table, and the day of the month in the left-hand Collumn, and in the Angle of meeting you have the Suns Right-ascension for the Month and day proposed.

The Use of Table XIX, page 259.

XIX. The nineteenth is a *Table of the Right-ascension and Declination* of the most notable fixt Stars, computed for the year 1700, but by the Differences that are adjoyned to them, it may serve for any other time, either past or to come.

It

It consists of five Columns, in the first are the names of the Stars, in the second their Rightascentions in time, in the third their Declinations, in the fourth the Difference of Rightascentions in 100 years, in the fifth the Difference of Declination in 100 years, and in the fifth their Magnitudes.

To take out the Rightascention and Declination, requires only your looking the Stars name in the first Column, and right against it under the respective Titles, you have the Declination and Rightascention.

The Declinations of the Stars are used in the very same manner, to find the Latitude by, as the Suns, the Rules for which you'l find in the latter Part of the *Navigation.*

If the time be above 10 years, before or after the year 1700, you must find the proportional Parts or Minutes to be added or subtracted; thus,

Say if 100 give the Minutes Difference: what shall 5, 10, or 20, years, *&c.* give?

Let it be required to find the Declination of *Caput Medusa* for the year 1750. In the Table I find its Declination for 1700, to be 39° 47′, and the Difference in 100 years to be 25′. As 100 . 25′ : : 50 to 12′, which added to 39° 47′, makes 39° 59′ the Declination.

Thus are the Differences of Rightascentions to be used for time to come: But will not need taking notice of till after the year 1720.

To find the time of a Stars coming to the Meridian.

Subtract the Suns Rightascention, from the Stars Rightascention if it may be, and the Remainder is the time of the Stars coming to the Meridian: but if the Stars Rightascention be less than the Suns, add thereto twenty four hours, and then subtract, and the Remainder is the time afternoon of the Stars coming to the Meridian: but if the Remainder exceed twelve hours, subtract twelve therefrom, and then the rest is the time from Midnight.

Example 2.

Suppose the time of *Aldebarans* coming to the Meridian, be required on *December* 18*th.*

I find in the Table the Stars Rightascention to be 4^h 17′, and the Suns to be 18^h 33′.

Now because the Suns Rightascention is more than the Stars, I add 24^h to the Stars which makes 28^h 17′, from which subtracting the Suns Rightascention there remains 9^h 44′, for the time afternoon of the Stars coming to the Meridian.

Bbb *Example*

Example 2.

Let the time of the bright Star in *Lyra* coming to the Meridian, *July* 25*th* be required.

The Stars Rightascention is	18^h	26′
The Suns Rightascention is	8	58
	9	28

To find what Star will be on the Meridian at any time proposed.

To the Suns Rightascention add the time from Noon given, the Sum is the Rightascention of a Star that will be on the Meridian at the time proposed: which looked amongst the Stars Rightascentions will shew you what Star it is that then culminates.

Let it be required to find what Star will be on the Meridian *July* 25*th*, at eight of the Clock at Night.

The Suns Rightascention for the time is	8^h	58′
The time from Noon is	8	00
The Sum is the Rightascention of a Star	16	58

Which looked in the Table of the Stars Rightascention shews it will be *Caput Herculis*, and the left shoulder of *Hercules* comes within a few Minutes after.

The Use of the Table of Versed Sines.

XX. The twentieth is a Table of *Versed Sines* both Natural and Artificial, whose uses are very many, too numerous to be here all treated of: I shall now only shew how by them more easily to solve some of the most useful cases of Spherical Triangles, which alone is enough to merit their publication. It has been a long time the votes and desires of many able Men in the Mathematicks, that such a table might be Collected and publisht, but especially of that ingenious and ancient Student Mr. *John Collins*, who has expressed his desire thereof more than once in his elaborate Pieces, and from whom I had the Loan of some Forin Tables, which did assist much towards the composing of these.

Prop.

Prop. I.

Two sides of an Oblique Spherical Triangle, with the Angle Comprehended, being given, to find the third side.

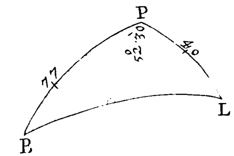
As the Cube of the Radius,
Is to the Rectangle of the sines of the Comprehended sides,
So is the Square of the sine of half the contained Angle,
To half the Difference of the Versed Sines *of the third side,*
And of the Ark of Difference between the two including sides.

Which is thus, Double the Logar. Sine of half the Angle given, and thereto add the Logar. Sines of the containing sides, and from the left hand of the Sum, dash out 3 for the *Cube* of the *Radius*, so rests the Logar. of half the Difference of those two *Versed Sines.*

Which half difference doubled, and added to the *Versed Sine* of the Difference of the Legs or containing sides, gives the *Versed Sine* of the side sought.

Example I.

In the Triangle BPL, let there be given the side BP 77° 00′, the side PL 40° 00′, and the contained Angle BPL 52° 30′, to find the side BL.



The Logar. Sine 40° 00′	9,8080675
The Logar. Sine of 77° 00′	9,9887239
The Logar. Sine of 26° 15′ *doubled*	19,2914116
The Natural Sine against	39,0882030
Is 1227355; *whose double is*	2454710
The Natural Versed Sine *of* 37° 00′, *the Diff. of the two sides is*	2013645
The Versed Sine *of* 57° 53′ *the side sought.*	4468355

If you make the third term, the Square of the Sine of half the Complement of the contained Angle to 180 Degrees, you will find the half Difference of the *Versed Sines* of the third side, and of the Sum of the two including sides to be doubled, and subtracted from the *Versed Sine* of the said sum.

But

But if instead of the second Tearm be taken into the Proportion, the double of the Rectangle of the Sines of the containing sides; that is, if the Logar. of the Number 2 be added to the Logar. of the other middle Terms, you will have the Logar. of the whole Difference in the last place: having found it, take the Natural sine that stands against it and add it to the *Natural Versed Sine* of the Difference of the Legs, and the sum is the *Natural Versed sine* of the side sought.

Example 2.

Let the two containing sides be 38° 30′, and 66° 30′, and the contained Angle be 20° 00′.

The Logar. Sine of 38° 30′	9,7941496
The Logar. Sine of 66° 30′	9,9623978
The Logar. of the Numbers 2	0,3010300
The Logar. sine of 15° 00′ *doubled is*	18,8259924
The nearest Natural sine against	38,8835698

66° 30′	*Is*	770091
38 30	*Which taken from the Nat. Versed sine of* 28° 00′	1170524
28 00	*There remains*	300433 the

Natural Versed sine of 53° 10′.

This Proposition is of great Use to Calculate the Distances of Places on Earth, according to the Arch of a Great Circle, by their Longitudes and Latitudes given; the Distances of Stars, by having their Declinations and Rightascentions, or Longitudes and Latitudes given, by means whereof the Altitudes of two Stars, or of the Sun with the Difference of time or *Azimuth* being observed at any time off the Meridian, the Latitude may be found.

FINIS.

GEOGRAPHY:

Or, a Brief

DESCRIPTION

Of the whole

EARTH.

THE Earths Surface, whose Description is properly termed Geography, is by many and sufficient Arguments made appear to be of no other than a Sphærical Figure; and the Circumference thereof hath in this our Age been more curiously than heretofore inquired into, and found by the Concordant Observations of the Gentlemen of the Royal Academy of *Paris*, and of our worthy Countryman Mr. *Norwood*, to be very near 25000 *English* Statute Miles, and consequently its Diameter 7958 Miles: The greater part of this vast Globe is covered with Water, which we call the Sea, out of which the Land rises with very slow Ascents, the hight of the highest Mountains and Prominences thereof scarce amounting to the two thousandth part of its Radius, and only serving to cause the Rivers to run with slow and easie Chanels. The Air on all sides encompasses it and renders it habitable, and the principle of Gravitation, whereby all Bodies descend towards its Center, is that which defends it from dissolution, by not permitting the least part thereof to be separated far from it; into the reason whereof Philosophers have hitherto inquired in vain. This Globe by its two-fold motion enjoys the grateful Vicissitudes of Day and Night, Winter and Summer; the former by turning round upon one of its Diameters in the space of 24 hours, and shewing all its sides successively to the Sun: This Diameter is called the Axis, and its extremities the Poles of the World, which by the experience of many Ages are found unalterable and fixt in the Earth, and the direction of this Axis by some unknown Magnetical Principle of Nature is always carried parallel to it self, during the time of the revolution of the other motion, whereby the Earth is carried round the Sun in the space of a year, and the Axis being inclined to the plain in which the annual motion is performed, causes the one Hemisphere to have more of the Suns light

light for the one half year, and the other Hemiſphere for the other. Theſe affections though neceſſary to be premiſed here, you will find explicated and demonſtrated more at large in the Aſtronomical part. We come now to the Explanation of the terms which have been thought proper in the illuſtration of Geography.

We muſt obſerve that there are greater and leſſer Circles, and that the former divide the World into two equal parts, and the latter into two parts alſo, but unequal. All theſe Circles ſeverally are divided into three hundred and threeſcore parts, which are called Degrees.

There are four greater Circles, to wit, the *Equinoctial*, the *Zodiack*, the *Horizon* and the *Meridian*, and as many leſſer, to wit, the Tropicks of *Cancer* and *Capricorn*, and the two Polar Circles, the *Artick* and *Antartick*.

The *Equinoctial* Circle is ſo called, becauſe when the Sun enters it, the days and nights are of an equal length; it is alſo called the *Equator*, becauſe it divides the World into two equal parts. Seamen call it only the Line. For the right underſtanding of this Circle, we muſt know that the Heavens ſeem to move upon two points, called Poles, the one bearing the name of *Artick*, and the other of *Antartick*; in a middle diſtance from which Poles this Circle is imagined to be: the uſe of it in Geography, is to divide the Earth into two parts, the one Northern, towards the Pole *Artick*, and the other Southern towards the other oppoſite Pole. The Latitude of places is reckoned from the *Equinoctial* where it begins, towards the Poles wherein it ends, and this ſpace contains ninety Degrees. Latitude is either Northern towards the Pole *Artick*, or Southern towards the *Antartick*.

The *Zodiack* is the Suns High-way, and this Circle cuts the *Equinoctial* into two equal parts, from which its greateſt diſtance is but twenty three Degrees and an half; it only ſhews what places of the Earth may have the Sun perpendicular, and more properly belongs to the Heavens than the Earth.

Horizon is as much as to ſay, boundary, becauſe that Circle limits our ſight, and divides the Heavens and the Earth into two parts, which are called Hemiſpheres, the one whereof we ſee, but cannot the other. There is a right *Horizon*, a Polar or Parallel one, and an oblique one; thoſe places that lye under the Equator, have a right *Horizon*, and are in the right Sphere; thoſe that are under either of the Poles have the Parallel Sphere: and all other places have an oblique *Horizon*, and are in an oblique Sphere. This Circle ſhews the Riſing and Setting of the Stars, and the four principal Quarters of the World, which are Eaſt, Weſt, South and North; the Eaſt is on the ſide of the Riſing Sun; the Weſt is where the Sun Sets; the North is towards the Pole *Artick*; and the South towards the *Antartick*. Theſe four Quarters are very neceſſary for diſtinguiſhing the limits of Regions, as will appear throughout this whole Treatiſe. From thence come the four principal winds, all which the *Horizon* ſheweth; but it is not marked on Maps, but only on the outſide of Globes and Spheres.

Meridian ſignifies Mid-day Circle, becauſe when the Sun is come to it; it is Noon in that place whereof it is the Meridian; for over every part of the Earth there is a Meridian, ſo that the number of theſe Circles is almoſt

almoſt infinite: However out of all thoſe there is one pitched upon which is called the great or firſt Meridian, or the Geographers Meridian. The Ancients choſe the Meridian of the *Canaries*, which they knew by the name of the fortunate Iſlands; and ſome Moderns make uſe of it ſtill in their Maps. Others have pitched upon the Meridian of the Iſles *Azores*, or Weſtern Iſlands, which lie to the Weſt of *Europe*. From this firſt Meridian the Longitude of places is reckoned from Weſt to Eaſt through the three hundred and ſixty Degrees of the Equinoctial, which is the circuit of the whole Earth; whereas Latitude is only reckoned to ninety Degrees, which make but a fourth part thereof.

The Tropicks are ſo called from a Greek Word *Tropos*, which ſignifies turning, becauſe when the Sun is come to one of theſe Circles, he returns again towards the Equinoctial.

The Tropick of *Cancer* is towards the Pole *Artick*, and that of *Capricorn* towards the *Antartick*, and both carry the names of the Signs of the *Zodiack* through which they paſs; each of them is diſtant from the Equinoctial, three and twenty Degrees and a half, which is the greateſt diſtance of the Sun from that Circle.

The Polar Circles go round the Poles, from which they borrow their names, and are diſtant each from his Pole twenty three Degrees and a half.

Of the Zones.

THE four leſſer Circles whereof we have been ſpeaking, divide the World into five parts, called *Zones*, that is to ſay, Belts or Girdles, becauſe they begird the whole Globe. One of them is Torrid, two are temperate, and two cold: The Torrid *Zone* is comprehended between the two Tropicks, and the people that inhabit it are called *Amphiſcians*, that is, ſuch as have their ſhadows both ways. To all places of this *Zone* the Sun comes perpendicular twice in a year, and therefore ſome of the Ancients believed this *Zone* inhabitable, by reaſon of too much heat; but we know it to be otherways now a-days.

The Northern temperate *Zone* is between the Tropick of *Cancer* and the *Artick* Polar Circle: The Southern temperate *Zone* is between the Tropick of *Capricorn*, and the *Antartick* Polar Circle. The Inhabitants of theſe *Zones* are termed *Heteroſcians*, that is, ſuch as have their ſhadow but one way.

The *Frigid Zones* are within the Polar Circles, the Northern within the *Artick*, and the Southern within the *Antartick*; the people of thoſe two *Zones* are called *Periſcians*, ſignifying that they have ſhadows round them on all ſides. To all places in theſe *Zones* the Sun in Summer never ſets for ſome days, and in the Winter he never riſes for as long time.

The Inhabitants of the World are diſtinguiſhed after another manner, according to the different Scituation they have to one another; as into *Antipodes*, *Antœcians* and *Periœcians*. The firſt are wholly oppoſite, and when it is Noon with us, with our Antipodes it is midnight, and they have Winter when we have Summer. Our *Antœcians* have Noon and Mid-night when we

we have them, but Winter for our Summer. And our *Periæcians* have the ſame ſeaſons that we have, but the hours quite contrary; for when we have Noon it is Mid-night with them.

Of Climates.

A Climate is a ſpace of the Earth contained between two Circles. Betwixt the beginning and end of a Climate, in the length of the longeſt day of Summer there is half an hours difference. For the clearer underſtanding of this, it is to be obſerved that Countries under the Equinoctial have all the year round twelve hours day and twelve hours night; but as places recede and are diſtant from the Equator, they become more and more unequal, and the days in Summer are longer than the nights. This inequallity is marked by the Climats; ſo that when on either ſide of the Equinoctial we find a place where the longeſt day of Summer is of twelve hours and a half, that is the firſt Climate, and ſo ſucceſſively till we come to the Polar Circle, where the longeſt day of Summer extends to twenty four hours: For beyond that Circle, the days encreaſe by whole days and months, until ye come to the Pole under which the whole year makes but one day and one night, ſix months long a piece. Climats take their names from the famous places through which they paſs.

Now to know in what Climate one is, we muſt from the number of hours of the longeſt Day in Summer ſubtract twelve, and double the Remainder; that is, reduce them into half hours, and that will ſhew the Climate wherein we live.

CHAP. I.

Of ſome proper terms of Geography.

HAVING explained the Circles that are uſeful to this Science, we are now to conſider ſome terms and words which are peculiar to it.

Continent is a vaſt ſpace of Earth, ſuch as that which comprehends *Europe*, *Aſia*, and *Affrica*; it is likewiſe called the main Land.

Iſland is a piece of Land ſurrounded with the Sea or other Water, and ſo divided from the Continent.

Peninſula, that is to ſay, almoſt Iſland, is a part of the Earth encompaſſed by the Sea on all hands, except on that part which joyns it to the Continent: the *Greeks* call it *Cherſoneſus*, a term ſometimes made uſe of in Geography.

Iſthmus is that Neck or Piece of Land that joyns a Peninſula to the Continent.

Promontory is a high Land running out into the Sea. The Moderns call it a Cape.

Moun-

Mountain is a part of the Earth higher than the reſt that is about it.

Ocean is that vaſt body of Water which environs the Continents, and is likewiſe called the Sea.

Gulph is an Arm of that Ocean running in between Lands. The *Latins* call it *Sinus*, and ſometimes it has the name of Sea.

Bay is likewiſe an Arm of the Ocean, but whoſe entrance is much wider than that of a Gulf.

Port is a ſmall part of Sea ſo hemb'd in by the Land, that Ships may there lie in ſafety.

Harbour is the ſame thing almoſt.

Streight or Frith is commonly taken for a Channel that joyns one Sea to another, or a Gulf to the Ocean; there is alſo a Streight or Neck of Land, which, as we have ſaid, is called an *Iſthmus*.

Banck is a heap of Sand in the Sea, which puts Veſſels in danger.

A *Shelf* is much the ſame, on which, and on hidden Rocks near the Surface of the Water Ships may ſplit and be caſt away.

Archipelago is a part of the Sea, where many Iſlands are.

River is a running Water that loſes its ſtreams in the Sea.

CHAP. II.

The Diviſion of the Earth and Sea.

THE moſt common Diviſion of the Earth is into four parts, which are *Europe*, *Aſia*, *Africa* and *America*: the three firſt are comprehended in one Continent, and is our old World; and the other makes an Iſland of it ſelf, called the new World, becauſe it hath not been diſcovered but ſince the Year one thouſand four hundred and ninety two: it is likewiſe called the *Weſt-Indies* in diſtinction from the *Eaſt-Indies* which are in *Aſia*.

Some Geographers divide the Earth into ſix parts, adding to the four which we have named, the *Artick* towards the Pole that gives it its name, and the *Antartick* towards the South Pole: this is called *Terra Auſtralis incognita*, or the Southern Land undiſcovered, and is thought to make a Continent as big as *Europe*, *Aſia* and *Africa*. Of theſe two laſt we ſhall ſpeak at the end of this Treatiſe.

Europe has *Aſia* on the Eaſt ſeparated from it by theſe limits, the *Egean* Sea or *Archipelago*, the Streights of the *Dardanelli*, the Sea of *Marmara*, the Streights of *Conſtantinople*, the *Black* Sea, the Streights of *Caffa*, the Sea *della Zabache*, the River *Tanais* and a Line drawn from its moſt Eaſtern Bank to the North Sea: it hath the ſame Ocean on the North, the *Atlantick* Sea on the Weſt, and the Streights of *Gibraltar* and *Mediterranean* Sea that divides it from *Africa*, on the South. From Weſt to Eaſt, that is, from Cape St. *Vincent*, in *Spain*, to *Conſtantinople*, it contains ſeven hundred ſeventy five

French

French Leagues; and from South to North, that is, from *Cape Malee* in *Morea* to the Northern Cape of the *Laplanders*, eight hundred and twenty five Leagues.

Asia has to the West the same bounds that divide it from *Europe*, and the *Red* Sea, with the Streights of *Suez*, that divide it from *Africa*; on the South the *Indian* Ocean, the Ocean of *China* on the East, and on the North, the Sea of *Tartary*, called *Mare Glaciale*. From East to West it contains seven hundred and fifty Leagues, from the *Archipelago* to the Ocean of *China*: and from South to North a thousand five hundred and fifty, reckoning from *Malacca* to the Sea of *Tartary*.

Africa has on the North the *Mediterranean* Sea, on the East the *Red* Sea, with the *Isthmus* of *Suez* that divide it from *Asia*, and the *Indian* Ocean: On the South the *Ethiopian* Sea, which with the *Atlantick* Ocean is likewise to the West of it. From West to East, that is, from Cape *Blank*, to the Cape of *Guardafuy*, it contains a thousand six hundred and fifty Leagues: and from South to North, that is, from the Cape of *Good Hope*, to the *Mediterranean* Sea, a thousand six hundred and seventy. It is on all sides encompassed with the Sea, except that narrow track of Land between the Red Sea and *Mediterranean*, which is not above thirty Leagues in Length: so that it is a perfect *Peninsula*.

America hath the North Sea to the East, the South Sea to the West, to the South the Streights of *Magellan*, which divide it from the *Terra del fuego*, and to the North unknown Lands or Seas. It is divided into two great *Peninsulaes*, by the narrow *Isthmus* of *Panama*, which is but eighteen Leagues over: From South to North, that is, from the Streights of *Magellan* to the Northern Ocean, it contains three thousand and fifty Leagues; and from West to East, towards *Mexico*, two thousand nine hundred.

The *Terra Australis*, and that of the North, are so little known to us, that their limits and extent cannot as yet be designed.

Having taken a view of the Earth, let us now cast our eyes on the Sea, which takes divers names according to the parts of the World where it is, or the Countries it washeth. That which encompasses Continents is called the Ocean; and this likewise hath different appellations, as on the West of *Europe*, and part of *Africa*, it is called the Western or *Atlantick* Ocean; towards the Cape of *Good Hope*, the *Ethiopick* Ocean; to the East of *Africa*, the *Indian* Sea; to the East of *Asia*, the Eastern Ocean, or Sea of *China*; to the North of *Asia*, the Sea of *Tartary*, and on the same side, and towards *Europe*, *Mare Glaciale* or the Frozen Ocean; to the East of *America*, the North Sea, and to the West, the South. These are the general denominations of the Sea, but it hath also particular names from the Countreys that lie near to it.

The chief Gulfs or Bays of the Ocean are the *Mediterranean* Sea, which lies betwixt *Europe*, *Africa* and *Asia*; the *Red* Sea, betwixt *Africa* and *Asia*; the Gulf of *Persia*, and that of *Bengala*, in the *East-Indies*; the *Baltick* Sea encompassed by *Germany*, *Sweden* and *Denmark*; the Gulf of *Mexico*, and that of St. *Laurence*, in *America*.

These

These Gulfs are joyned to the Ocean by Streights; the *Mediterranean* Sea by the Streights of *Gibraltar*; the *Red* Sea by that of *Babel-mandel*; the *Persian* Sea by the Streights of *Bassora*, otherwise of *Ormus*. The Gulfs, or rather Bays of *Bengala*, *Mexico* and St. *Laurence* have no Streights, because their mouth or entry is very large.

The *Baltick* Sea has the famous Streight of the Sound.

The *Mediterranean* Sea hath some noted Bays that well deserve to be mentioned. Betwixt *Italy* and *Dalmatia* is the Gulf of *Venice*, called in antient times the *Adriatick* Sea. In *Greece* is the Gulf of *Lepanto*, heretofore of *Corinth*. And in *Macedonia* that of *Salonica*, formerly of *Thessalonica*.

Between the *Egean* Sea, now called the *Archipelago*, and the *Propontis* or Sea of *Marmora*, there is a Streight heretofore called the *Hellespont*, and at present the Streights of *Gallipoli*, or the *Dardanelli*, and St. *Georges* Channel; between the Sea of *Marmora* and the black Sea, formerly called the *Euxin* Sea, is the *Bosphorus* of *Thrace*, which is now adays called the Channel of the *Black* Sea, or Streights of *Constantinople*, because that famous City is seated there; betwixt the *Black* Sea and the *Palus Meotides*, at present called the Sea *delle Zabache*, is the Streights of *Caffa*, heretofore named the *Cimmerian Bosphorus*.

Betwixt the Island of *Eubœa*, at present *Negropont*, and *Greece*, there is a narrow passage of Sea, by the Ancients called *Euripus*, who have affirmed that it ebbed and flowed seven times a day. There are some other famous Streights which joyn several parts of the Ocean together; or to say better, the Ocean to the Ocean it self.

Towards the Northern Ocean is the Streights of *Waigatz*, between *Tartary* and *nova Zembla*; between *Cathay* and the Land of *Jesso*, is the Streights of *Jesso*; between *Japan* and the Land of *Jesso*, is the Streights of *Sengar*; between the same Land and *Califurnia*, is that of *Anian*; between *Estotiland* and *Greenland*, is that of *Davis*; between *Greenland* and the Island of *Elizabeth*, is that of *Forbisher*.

Towards *Canada* is that of *Hudson*, which according to the new Maps is properly a Gulf.

Towards the *Terra Australis* is the famous Streights of *Magellan*, discovered by him who gave it the name, in the year one thousand five hundred and twenty, between *America* and the *Terra del fuego*.

Betwixt this Land and that of the States, is the Streights of *Le Maire*, discovered in the year one thousand six hundred and sixteen.

And between that Land of the States and the *Terra Australis*, is the Streights of *Brouvers*, discovered in the year one thousand six hundred and forty three. These three last Streights joyn the North and South Seas together, and serve for a passage from one to the other.

Between *Califurnia* and new *Mexico*, there is a Gut of Sea, or Streights, which is called the *Vermeillian* Sea, and was taken for a Bay before that *Califurnia* was discovered to be an Island.

We

We must not omit a Sea that is separated from all others, and which indeed is but a Lake of a vast extent, and that is the *Caspian* Sea, called at present the Sea of *Bachu* or *Kilan*. The Ancients imagined it to have been a Bay or Gulf of the North Sea, but it is now known to be on all sides encompassed with Land; it hath *Persia* to the South, and *Tartary* to the North of it: In some Relations it is reckoned to be eight hundred Leagues in Circumference.

Let us now give a hint of the greatest Rivers in the World, beginning with those that fall into the Ocean, on all sides of our Continent or old World.

In *Europe* are the River *Tagus*, the *Garronne*, the *Loyre*, the *Sein*, the *Scheld*, the *Rhine* and the *Elbe*.

In *Asia* the *Oby*, the yellow and blue Rivers, *Ganges* and *Indus*.

In *Africa*, *Cuama*, the River *de Spiritu Sancto*, the *Zaire*, and the *Niger*.

In *America* the Rivers of St. *Laurence*, *Oranoque*, the *Amazons*, and *Rio de la Plata*.

Into the *Mediterranean* Sea on the side of *Europe*, fall the *Ebre*, the *Rhosne*, and the *Tiber*; into the Gulf of *Venice*, the *Po*; into the *Euxin* Sea the *Danube*, and the *Borysthenes*, now called *Nieper*, and the River *Tanais* runs into the *Palus Meotis*.

On the *African* Shore the *Mediterranean* receives no famous River but the *Nile*.

In *Asia*, *Euphrates* and *Tygris* having mingled their streams fall into the *Persian* Gulf, and the *Volga* into the *Caspian*.

The *Oder* and the *Weissel*, or *Vistula*, discharge themselves into the *Baltick*; and the *Duina* into the *White* Sea.

We shall not speak of the chief Lakes till we come to describe the particular Regions wherein they are:

But we will here subjoyn the most noted Mountains of the World, such as in *Europe* are, the *Pyrenees*, the *Alps* and *Appenine-Hills*. In *Asia*, *Taurus*, *Caucasus* and *Imaus*; in *Africa*, *Atlas* and the Mountains of the Moon: and in *America* the *Cordilleras* or *Andes*. The Islands we shall describe as we come to the several parts of the Earth near to which they lie.

Thus, Reader, you have a general description of the whole Earth, and Seas that environs it, or fall into its bosom. We must now descend to a more particular Description; and shall begin with that of *Europe*.

CHAP.

CHAP. III.

Europe.

EUROPE, whereof we have already mentioned the limits, is the smallest, but most considerable for Learning and Arts of the four parts of the World: it comprehends the following Kingdoms and Regions. *Spain*, *France*, *Italy*, the *Low Countries*, *Germany*, *Hungary*, *Transilvania*, *Moldavia*, *Walachia*, *Bessarabia*, *Dalmatia*, *Bosnia*, *Servia*, *Bulgaria*, *Romania*, *Greece*, *Norway*, *Denmarke*, *Sweden*, *Poland*, *Prussia*, *Lithuania*, *Livonia*, or *Liefland*, *Muscovy*, and the lesser *Tartary*. Its chief Islands in the Ocean, are *Great-Britain*, *Ireland*, the *Orcades* and *Hebrides*, *Iseland*, and the *Azores*. In the *Mediterranean* Sea, *Majorca*, *Minorca* and *Yvica*, the Isle of *Elbe*, *Corsica*, *Sardinia*, *Sicily*, *Candia*, *Negropont*, and many more in the *Archipelago*. We shall speak of its Rivers, Lakes, and Mountains, when we treat of the Regions wherein they are.

CHAP. IV.

Spain.

SPAIN is surrounded by Seas on three sides; on the East and South it is watered with the *Mediterranean*, and the Famous Streights of *Gibraltar* divide it from *Africa*; to the West it hath the *Atlantick* Ocean, and to the North partly the *Cantabrick* Ocean, or Bay of *Biscay*, and partly the *Pyrenean* Mountains that reach from the *Mediterranean* to the Ocean, and divide it from *France*: most part of its Provinces are honoured with the Title of Kingdoms. On the *Mediterranean* are *Catalonia*, of which the Metropolis is *Barcelonna*, a large City, with a Sea-Port: the other Towns are *Terragonna*, an Archbishoprick, *Tortose*, *Gironne*, *Lerde* or *Lerida*.

The Kingdom of *Valencia* with a Metropolis of the same name, and *Alicant*; the Country about which produces the best Wines in *Spain*.

The Kingdom of *Murcia*, the chief City whereof carries the same name. In this Province stands *Carthagena*, a very good Sea-Port.

The Kingdom of *Granada* that hath its name from its Metropolis lies to the West of that, and hath the Cities of *Malaga* and *Almeria*.

Andalusia is partly on the *Mediterranean* and Streights of *Gibraltar*, and partly on the Ocean. Its chief City is *Seville*, (one of the loveliest Towns in the World) seated on the *Guadalquivir*. Its other Towns are *Cordova*, the Native place of *Seneca* and *Lucan*, *Xeres* from whence our Sherries come,

Saint *Lucar* and the Famous Port of *Cadez* or *Cales*, which ſtands in a ſmall Iſland of that name, very near to the Main on its Eaſt ſide.

The Provinces waſhed by the Ocean, are

The Kingdom of *Algarve*; its Cities are *Sylvis* and *El Faro.*

The Kingdom of *Portugal*, anciently called *Luſitania*; which hath *Lisbon* a large fair City, and Arch-biſhoprick for its Capital: the other chief Cities thereof are *Braga*, an Arch-biſhops See, *Evora* and *Conimbre* a Famous Univerſity; this is now, and for many Ages hath been ſubject to a King of its own independent of *Spain.*

The Kingdom of *Galicia* hath *Compoſtella*, where the Body of St. *James* is, for its Metropolis, and *Corunna* a good Sea-Port: this is the North-Weſt corner of *Spain.*

Aſturia, whereof *Oviedo* is the Metropolis, lies to the Eaſt of *Galicia*, fronting the Bay of *Biſcay*: and yet more Eaſterly on the ſame Coaſt lies *Biſcay*, whereof the chief City is *Bilboe.* And to this is adjoyned *Guipuſcoa*; whereof *Toloſe* or *Toloſette* is the Capital City: its other Cities are St. *Sebaſtian*, which hath a good Port, and *Fontarabie.* At the foot of the *Pyrenees* are the Kingdoms of *Navarre* and *Arragon.*

Pampelonna is the Metropolis of the Kingdom of *Navarre*; its other Cities are *Victoria* and *Eſtella.*

Sarragoſſa is the Capital City of the Kingdom of *Arragon*, and a Univerſity; the others are *Hueſca*, *Albarazin*, *Calatayud*, which ſome take for the ancient *Bilbilis*, the Native Town of the Poet *Martial*: In the heart of *Spain* are *Leon*, the two *Caſtilles*, the old and new, and *Eſtremadura.*

The Metropolis of the Kingdom of *Leon* bears the ſame name; *Aſtorga* and *Samora* are its other Cities.

Bourgos, an Archbiſhops ſeat, is the Capital City of old *Caſtille*; its other chief Towns are *Valladolid*, where ſome Kings of *Spain* have kept their Courts: *Palenca*, *Salamanca* a famous Univerſity. *Numance* that heretofore reſiſted the *Roman* Forces ſo long, was in this Province, but there remains no Footſtep of it at preſent.

Toledo is the Metropolis of new *Caſtille*, and the Archbiſhop of it is Primate of all *Spain*, it is a ſtately and large City: The other chief Towns of that Province are *Madrid*, the uſual Reſidence of the Kings of *Spain*, and five Leagues Weſt from that, the famous Monaſtery of St. *Laurence*, called the *Eſcurial*, built by *Philip* the Second, and before it was burnt, one of the moſt Magnificent Fabricks in the World.

Alcala de Henares, famous for the Univerſity that Cardinal *Ximenes* Founded there.

Each of the two *Caſtilles* is qualified with the Title of Kingdom.

Eſtremadura hath two conſiderable Towns, *Badajos* and *Merida.*

The chief Capes in *Spain* are on the *Mediterranean*, Cape *Palafagel* in *Catalonia*, Cape *Martin* in the Kingdom of *Valencia*, Cape *Palos* in *Murcia*, and Cape *de Gates* in the Kingdom of *Granada*, Cape St. *Vincent* in *Algarbe*, Cape *de Spichel* and *de Roca* in *Portugal*, and Cape *Finiſterre* and Cape *Ortogal* in *Galicia*, and Cape *de las Pennas* in *Aſturia.*


PORTUGALL.
Leagues
5 . 10 . 15 . 20 . 25
OCEANUS
MAR
DE
PORTUGAL.
OCCIDENTALIS.
GALICE.
Entre Douro et Minho
Tra los Montes.
Bevra.
Estremadura
Alenteio
ALGARVE.
ANDALOUSIE.
LEON.
CASTILLE.
Estremadura.
The Golfe of Cadis
Braga
Porto
Coimbra
Lisbone
Lisboa
Santaren
Setuual
Euora
Beia
Silues
Lagos
Faro
Tauila
Ayamonte
Badaioz
Oliuenca
Palos
C. de S. Vincent
C. de Roca
I. Barlenga
Belem
Palmela
Cascais
Sintra
Leiria
Obedos
Tomar
Viseu
Guarda
Lamego
Bragança
Miranda
Viana
Barcelos
Valença
Alcantara
Portalegre
Castelbranco
Estremoz
V. Vicosa
Moura
Serpa
Mertola
Alcaçer de Sal
Odeseixa
Almodavar
Ourique
Viana
Monsaraz

The chief Rivers that fall into the *Mediterranean* are the *Ebre* or *Iberus*, which runs through *Arragon* and *Catalonia*, and passes by *Sarragossa* and *Tortose*; the *Guadalaviar* that passes by *Valencia*, and the *Xucar* in the same Kingdom; the *Guadalentia* in the Kingdom of *Murcia*: those that discharge themselves into the Ocean, are the *Guadalquivir*, otherways *Betis*, that runs through *Andalusia*, and passes by *Cordova* and *Sevil*, and empties it self into the Sea at St. *Lucar de Barrameda*: the *Guadania* in *Estremadura*, which River, a little above *Merida*, runs under ground for several Leagues, and then breaks out again.

The *Tagus* which waters new *Castile* and *Portugal*, passes by *Toledo* and *Lisbon*.

The *Douero* that runs through old *Castile* and *Portugal*, and the *Minho* that divides *Portugal* from *Galicia*.

The chief Mountains are the *Pyreneans*, *Sierra Morena*, *Sierra D' Alcaraz*, *Sierra D' Albarazin*, and the *Sierra Nevada*, commonly called the *Granadas*.

The Isles upon the Coasts of *Spain*, are the Isle of *Cadiz* in the Ocean; and near to *Andalusia*, the *Baleares*, to wit, *Majorca* and *Minorca*, the Isles of *Yvica* and *Formentera* in the *Mediterranean*.

The King of *Spain* is not at present Master of all these Provinces, for *Portugal* and *Algarbe* belong to the King of *Portugal*; and the King of *France* has made some incroachments in *Catalonia*.

There is no Religion professed in *Spain* but the Roman Catholick.

A Table of the Longitudes and Latitudes of the chief Cities and Towns of the Kingdom of *Spain*.

1. In the Kingdom of *Galicia*.

	Lat.		*Long.*	
Compostella.	42	3	10	2
Lugo.	42	4	11	4
Corunna.	42	5	10	2
Finisterre.	43	0	9	2
Cape *de Ortegul.*	43	2	11	1
Tuy.	41	3	10	2

2. In the Kingdom of *Leon*.

Leon.	42	1	13	5
Astorga.	41	5	13	4
Camora.	41	2	13	5
Salamanca.	40	4	13	4
Ciudad Rodrigo.	40	1	12	4

3. In the Kingdom of *Asturia*.

Oviedo.	43	0	13	1
Cape *de las Pennas.*	43	3	12	4
Santilliana.	43	0	14	3

4. In *Biscay*.

	Lat.		*Long.*	
Cape *Machachaca.*	43	4	16	4
Bilbao.	43	2	16	4
Larido,	43	1	16	0
Espinosa.	43	0	15	2
St. *Sebastian.*	43	2	17	4
Vittoria.	42	4	16	2

5. In *Navarre*.

Pampelona.	43	0	18	1
Estella.	42	4	17	4

6 In the Kingdom of *Arragon*.

Saragosa.	41	2	19	0
Husca.	41	4	19	4
Jaca.	42	2	19	1
Catalayud.	40	5	18	1
Darosa.	40	3	18	1
Albarazin.	40	0	18	2

	Lat.	Long.
Tervel.	39 3	19 0
Calanda.	40 2	19 2

7. In *Catalonia.*

	Lat.	Long.
Barcelona.	40 3	22 3
Tarragona.	40 0	21 5
Tortose.	39 4	20 4
Lerida.	40 4	20 4
Solsone.	41 1	21 1
Cordone.	41 2	21 2
Blanes.	40 4	23 1
Vich.	41 0	21 5
Girone.	41 1	23 1
Monserrat.	40 3	21 5
Barraves.	42 1	21 4
Roses.	41 3	23 5
Cape *de Palafagel.*	40 4	24 0
Flix.	40 1	20 3

8. *Roussillon.*

	Lat.	Long.
Perpignan.	42 0	23 2

9. In the Kingdom of *Valencia.*

	Lat.	Long.
Valencia.	38 4	19 1
Segorbe.	39 1	19 2
Denia.	37 5	19 4
Cape St. *Martin,*	37 4	20 0
Bonifaca.	39 4	20 0
Xativa.	38 1	18 5
Cullera.	38 1	19 3
Segentum.	38 4	19 4
Alicant.	37 3	19 2
Xelva.	39 2	18 2
Origuela.	37 3	18 4

10. In the Kingdom of *Granada.*

	Lat.	Long.
Granada.	36 5	16 0
Guadix.	36 5	16 3
Almeria.	36 1	17 2
Salobrenna.	36 2	16 3
Malaga.	36 0	14 4
Ronda.	36 1	13 5
Marbello.	35 5	14 0
Velez.	36 2	15 1
Ubeda.	37 4	15 5

	Lat.	Long.
Muxacra.	36 2	17 4
Vera.	36 4	17 5
Cape *de Gates.*	36 0	17 4

11. The Kingdom of *Murcia.*

	Lat.	Long.
Murcia.	37 1	18 4
Carthagena.	36 5	18 5
Cape *de Palos.*	36 4	19 1
Lorca.	37 1	17 3

Isle of *Majorca.*

	Lat.	Long.
Majorque.	38 2	22 5

Isle of *Minorca.*

	Lat.	Long.
Port *Mahon.*	38 4	24 2

In the Isle of *Ivica.*

	Lat.	Long.
Ivica.	37 4	21 1
Isle of *Formentera.*	37 2	21 1

12. Kingdom of *Andalusia.*

	Lat.	Long.
Sevil.	37 0	13 2
St. *Lucar.*	36 2	12 4
Xeres.	37 1	11 3
Palos.	36 5	12 0
Cadiz.	35 5	12 4
Medina Sidonia.	36 0	13 2
Ecua.	36 5	14 3
Cordova.	37 2	14 5
Ayamont.	36 5	11 3
Port *Real.*	36 1	13 0
Gibralter.	35 2	13 3
Tariffa.	35 2	13 1
Lucena.	36 5	15 1
Aromes.	37 4	12 4

13. New *Castile.*

	Lat.	Long.
Madrid.	39 5	15 5
Toledo.	39 1	15 4
Alcala de Hen.	40 0	16 2
St. *Cruz.*	39 0	16 2
Ciutad Real.	38 2	15 2
Malagon.	38 4	15 4
Huetta.	39 1	17 0

Cuensa.

	Lat.	Long.
Cuensa.	38 5	17 1
Escurial.	39 5	15 3

14. *Estremadura.*

	Lat.	Long.
Bajadox.	38 2	12 2
Alcantara.	39 0	12 4
Merida.	38 2	13 0
Truxil.	38 3	13 4

15. In the Kingdom of old *Castile.*

	Lat.	Long.
Burgos.	42 0	15 4
Valladolid.	41 2	14 5
Villa Franca.	40 1	14 0
Soria.	41 2	17 0
Osma.	41 0	16 5
Avila.	40 2	14 2
Placentia.	39 2	13 5
Coria.	39 4	13 0

A Table of the Longitudes and Latitudes of the most considerable Places in the Kingdom of *Portugal.*

In the Province called *Entre Douro & Minho.*

	Lat.	Long.
Braga.	41 1	10 4
Porto.	40 5	10 3
Viana.	41 2	10 1
Guimaranes.	41 1	10 5
Amarante.	41 1	11 0
Melgaon.	41 5	10 3
Valensa de Minho.	41 4	10 2
Ponte de Lima.	41 3	10 3
Barcelos.	41 1	10 2

In the Province *Tra los Montes.*

	Lat.	Long.
Tragansa.	41 4	12 4
Miranda.	41 1	12 5
Cassel Rodrigo.	40 3	12 3
Villa Real.	41 0	11 3
Chaves.	41 4	11 4
Spadacinta.	40 5	12 4
Pinhel.	40 2	12 2
T. de Moncorvo.	40 5	12 2
Marialva.	40 3	12 1
Almeida.	40 1	12 4

In the Province of *Beira.*

	Lat.	Long.
Coimbra.	39 5	10 4
P. Aveiro.	40 2	10 2
Goes.	39 5	11 0
Mira.	40 1	10 1
Lamego.	40 5	11 3

	Lat.	Long.
Visen.	40 2	11 2
Guarda.	40 0	12 1
Trancoso.	40 3	11 3
Castel Branco.	39 3	11 5
Val. Verde.	40 4	11 4
Sabugal.	40 0	12 2
Idenha.	39 3	12 2
Cape *de Mondego.*	39 5	10 0

In the Province of *Estremadura.*

	Lat.	Long.
Lisbon.	38 3	9 2
Almada.	38 2	9 3
Setuval.	38 1	10 0
Orem.	39 3	10 2
Alemover.	38 5	9 5
Ega.	39 4	10 2
Leiria.	39 3	10 1
Tomar.	39 2	10 4
Punhete.	39 1	10 5
Palmela.	38 2	9 5
Azarzedas.	39 3	11 3
Figuera.	39 4	10 5
Sintra.	38 4	9 1
Cascales.	38 3	9 1
Atalaia.	39 1	10 3
Santarem.	39 0	10 2
Almerin.	39 0	10 3
Obedes.	39 1	9 4
Berleng Island.	39 1	9 1
Rock of *Lisbon.*	38 3	9 1
Cape *de Spichel.*	38 1	9 3

In

	Lat.		Long.	
In the Province of *Alentejo.*				
Evora.	38	0	11	1
Elvas.	38	2	11	5
Portalegro.	39	0	11	5
Villa Vicosa.	38	2	11	4
Beja, or *Bexa.*	37	3	10	5
Olivenza.	38	1	11	5
Montalva.	39	1	11	5
Estramoz.	38	2	11	2
Avis.	38	4	11	1
Aliastiel.	37	2	10	3
St. *Jago de Cacem.*	37	3	10	0
In the Kingdom of *Algarve.*				
Silves.	36	5	10	2
Lagos.	36	3	10	0
Faro.	36	3	10	4
Tavila.	36	4	11	0
Cape St. *Vincent.*	36	3	9	4

CHAP. V.

France.

FRANCE is bounded on the East by *Italy*, from which it is divided by the River *Var* and the *Alpes*; by *Savoy*, *Switzerland*, the *Franche Comte*, *Germany*, and the *Low-Countries*, which are likewise to the North of it, with the Channel or Narrow Sea that divides it from *England*; on the West by the Ocean, and on the South by the *Pyrenean* Hills and the *Mediterranean*. We shall first describe its Provinces that are washed by the Ocean, proceeding from North to South.

Picardie hath *Amiens* for its Capital City; the other more considerable Towns are *Abbeville*, *Perone*, *Roye*, *Corbie*, St. *Quintin*, *Calais* and *Boulogne*, which two are Sea-Ports; *Soissons*, *Laon*, *Beauvais*, *Montrueil*, *Dourlans*, *Crecy*, where *Philip de Valois* lost a Battel to the *English*, *Guise* and *Rhetel*.

Normandy hath *Rouen* its Capital; its other principal Towns are *Eureux*, *Bayeux*, *Caen*, *Diepe*, *Constance*, *Auranche*, and *Havre de Grace*.

Bretagne whereof *Rennes* is the Capital City, *Nantes*, *Vannes*, S. *Malo*, *Beauport*, *Lantriguier*, *Brest* and *Blavet*, are its other Towns.

Poictou contains *Poictiers* its chief Towns, *Luson*, *Maillezais*, *Niord*, *Fontenay*, *Chastelleraud*: *Rochel* is in the *Aulnis*.

Xaintonge hath for its Capital *Xaintes*, where some *Roman* Antiquities are still to be seen; its other Towns are *Blay* and St. *John d' Angeli*.

Guienne hath *Bourdeaux* upon the *Garonne* for its principal City; at the mouth of that River stands the Tower of *Cordouan*, a stately building, and serves for a Sea Mark to Ships. Under the name of *Guienne* several Countries are comprehended, as the *Agenois*, where are *Agea*, *Marmande*, *Clairac*; the *Condomois*, where are *Condom* and *Nerac*. The County *D' Armagnac*, where are *Auch* and *Lectoure*; the County of *Cominges*, where are *Bertrand*, *Coserans* and *Lombez*; the other Towns of *Guienne* are *Bazas*, *Ayres*, *Acqs* and *Bayonne*.

The

The *Basse Navarre* lies at the foot of the *Pyrenees*; its chief Towns are *Palais*, and St. *John de Pied de Port*.

The Principality of *Bern* is likewise at the foot of these Mountains; its Capital is *Pau*, and the other Towns of any note, are *Oleron* and *Lescar*.

Bigorre hath *Tarbes* for its Capital; *Bagueres* is likewise considerable there, because of its hot Baths from whence it has its name.

The County of *Foix* lies at the foot of the same Mountains; besides its chief Town of the same name, it hath the Town of *Pamies*.

The County of *Roussillon* taken from the *Spaniard* has the same Situation, and *Perpignan* is its Capital.

Languedoc comes next, and stretches along the *Mediterranean* which it hath to the South, being bounded on the North by the Mountains of *Auvergne*. The *Rhosne* divides it from *Provence* and *Dauphine* on the East, and *Guienne* borders on it to the West; its Capital City is *Tholouze*, *Montpelier* is the next: the Bishops seat was at *Maguelonne*, which is now ruined, nothing remaining but two Churches. It stood in an Isle in the middle of a Pool or Lake, which hath Communication with the Sea. This is that Town which *Ptolomy* calls *Agatha*, and which some Geographers take for *Agde*; but that Author calls this last *Agathopolis*, near the *Eraut*, which removes all doubt: besides, that he calls *Agatha* an Isle and City. Now there never was any City in an Isle upon that Coast, except *Maguelonne* alone, which changed its name with the Fate and Wrack of the *Roman* Empire. It is somewhat strange that the greatest Geographers should have been ignorant of this which is so easie to be perceived by any that will consider *Ptolomy* and the Situation of that Country. I make this remark in favour of *Montpellier*, which is enlarged by the Ruins of *Maguelonne*; enriched with its spoils, and adorned with its Bishoprick which was transferred thither by Pope *Paul* the third, in the Reign of *Francis* the first, the Year one thousand five hundred and thirty six. The other Towns of *Languedoc*, are *Narbonne*, an ancient *Roman* Colony, as well as *Nismes*, which by its stately Antiquities still shews what was heretofore the splendor of that place: There is an Amphitheatre, the most entire of any that is to be seen of that kind in the World, a Royal Palace, and some other magnificent Reliques of the *Roman* Age. Four Leagues from this City is a stately Aqueduct, which is called the *Pont du Guard*, because it is upon a River of that name. *Carcasson*, *Besiers*, *Agde*, *Viviers* and *Beaucaire*, famous for the Fair of *Magdalene*, are the other Towns of this Province, which is one of the pleasantest in *France*.

Provence is divided from *Languedoc*, that lies to the West of it, by the *Rhosne*, and from the County of *Nice*, which it hath to the East, by the *Var*; and from *Piemont* by the *Alpes*, it hath the *Mediterranean* to the South, and *Dauphine* to the North: its chief Towns are *Aix* its Capital, *Marseilles*, *Arles*, *Frejul*, *Thoulon* one of the best Sea-Ports in *France*, *Hieres* and some others: St. *Maximin* preserves the Body of *Mary Magdalen*.

The County of *Venaissen* that belongs to the Pope is shut in within the limits of this Province, its Towns are *Avignon*, *Carpentras*, *Cavaillon* and *Vaison*.

The

The Principality of *Orange* belonging to the Princes of the House of *Nassaw*, who from thence have their Title, is inlocked within the County of *Venaissin*. There is no considerable Town in it, but that of *Orange*, where are the Ruins of an Amphitheater, and a Triumphal Arch of *Marius*.

Dauphine, which is divided from *Languedoc* by the *Rhosne*, and from *Piemont* by the *Alpes*, contains these principal Towns following; *Grenoble* its Capital, and *Ambrun*; this upon the *Durance*, and that upon the *Isere*: *Vienna* and *Valence* upon the *Rhosne*, both very ancient.

The *Lyonnois* is to the North of *Dauphine*, and *Lions*, one of the greatest and fairest Cities of *France*, is its Capital; it's situated on a point where the *Saone* mingles its still and gentle waters with the rapid streams of the *Rhosne*: it hath no other Towns of great note.

Bresse is to the North of the *Lyonnois*; its chief Towns are *Bourg* in *Bresse*, *Montluel*, *Pont de Vaux*, and St. *Julian*.

The Principality of *Dombes*, which belongs to *Madamoiselle* of *Montpensier*, Cousin German to the King of *France*, is inclosed within *Bresse*; the chief Town of it is *Trevoulx*.

The Dutchy of *Burgundy* lies Northward from the *Lyonnois*, between which and it, are the *Beaujolois*, the chief Town whereof is *Ville Franche*, and the *Maronnois*, that takes its name from the Town of *Maron*: the chief Towns of *Burgundy* are *Dijon* the Capital, *Authun* an ancient Town, *Chalons* on the *Saone*, *Beaune*, *Semur* and *Langres*; some place *Sens* and *Auxerre* here.

Champaign hath *Burgundy* to the South, and *Picardy* to the North; its chief Towns are *Rheims*, *Troyes*, *Chalons* on the *Marne*, *Bar* on the *Sein*, *Bar* on the *Aube*, *Nogent*, *Chaumont* in *Basigny* and *Joinville*. Seeing *Champaign* joyns *Picardy*, and that we began the Description of the Circuit of *France* by this, we will end it here, that we may view the middle of the Kingdom, and describe the Provinces that lie there, proceeding from North to South.

Brie lies to the West of *Champaign*; its chief Towns are *Meaux*, *Province*, *Lagny*, *Bricomte-Robert* and *Montereau*.

France, properly so called, lies West from *Brie*, and hath *Picardy* to the North; it comprehends the *Prevostie* and *Vicecounty* of *Paris*, the Isle of *France*, the *Valois*, the *Heurepois*, and the *Gastinois*: *Paris* is the Metropolis of all this Kingdom, the Residence of the Kings, and one of the fairest Cities in the World. In the Isle of *France* is St. *Denis*, the burying place of the *French* Kings; *Poissi*, St *Germain*, and *Montmorency* are the other more remarkable Towns thereof. In the *Valois* are *Crespi*, *Senlis*; and *Beauvois*, with the *Beauvoisis*, is by some also placed there. In the *Heurepois* are *Melun*, *Corbeil*, *Mores*: in the *Gastinois* are *Montargis*, *Nemours*, *Estampes*, *Milly*, *Chastillon* and *Fontainbleau*, where the *French* King has a stately House in a vast Forrest.

The *Beausse* hath for chief Towns, *Orleans*, *Chartres*, *Dreux*, *Chasteaudun*, *Vandosme*, *Meun*, *Nogent le Roy* and *Blois*.

Perche hath for principal Towns, *Nogent Le Retrou*, *Molesme* and *Mortagues*.

Anjou hath *Angiers*, *Saumeur* and *La Fleche*.

Tourain

Tourain hath *Tours*, which gives it the name, *Amboise*, *Loches*, *Chinon*, where *Rablais* was born, *Loudun* and some others.

Sologne hath *Remorantin*, *Gergeau* and *Sully*.

Berry, which is almost in the middle of *France*, hath *Bourges* its chief Town, *Sancerre*, *Yssoudun*, *Vierzon*, *Dun Le Roy* and *Selles*.

The *Nivernois* hath *Nevers*.

The *Bourbonnois* hath *Moulins*, *Bourbon L' Ancy*, and *Bourbon L' Archambaud*.

The *Forrest* hath St. *Estienne de Feuran*, *Mont Brison*, *Feurs*, and *Rouenne*.

Auvergne is divided into the upper and lower; in this are the Towns of *Clermont*, *Ryons*, *Montferraud*, and the Castle of *Montpensier*: in the upper, St. *Flour* and *Aurilhac*.

Lymoisin hath *Limoges* its Capital Town, *Segur* and *Chalus*, which are in the upper; and *Tulles*, *Uzerche* and *Brive* in the lower, called otherways *La Marche*.

Quercy hath for Capital *Cahors*, the other considerable Towns are *Montauban* and *Moissac*.

Perigord hath *Perigueux*, *Sarlat*, *Bergerac* and *Miremont*.

Rouvergne hath *Rhodez*, *Ville Franche*, and *Milliaud*.

The *Angoulmois*, *Angoulesme*, *Chateau-neuf*, *Coignac* and *Jarnac*, where the bloody Battel was fought in time of *Charles* the Ninth, which bears that name. And this is a brief Description of all the Provinces of *France*.

We must now see what Rivers water it. Those that run into the Ocean are the *Garonne*, the *Charente*, the *Loyre*, the *Sein* and the *Somme*. Into the *Mediterranean* Sea, the *Aude*, the *Eraud*, and the *Rhosne*.

The *Garonne* hath its source in the *Pyrenean* Hills, runs through *Guienne*, passes by *Thoulouze* and *Bourdeaux*, receives into it the *Ariege*, the *Lot*, the *Tarn* and the *Dordogne*, and falls into the Ocean near to *Bourdeaux*.

The *Charente* passes by *Angoulesme* and *Xaintes*.

The *Loyre* hath its Head in *Languedoc*, among the Mountains of *Vivarezi*; from whence it enters into the Forrests, and passes by *Rouenne*, where it begins to carry Boats, it runs through the *Bourbonois*, the *Nivernois*, *Beausse*, *Tourain* and *Anjou*, passes by *Nevers*, *Orleans*, *Blois*, *Amboise*, *Tours*, *Saumeur*, and entring a little into *Bretaign*, and having washed *Nantes*, it discharges it self into the Ocean, carrying with it the *Allier*, the *Clein*, the *Creuse*, the *Cher*, the *Vienne*, the *Mayne*, and many Rivulets.

The *Sein* comes out of *Burgundy*, waters *Champaign*, the Isle of *France* and *Normandy*; it passes through *Paris*, and by *Rouen*, and being encreased by the *Marne*, the *Yonne*, the *Oyse*, and some other Rivers, it is embraced by the Ocean near *Havre De-grace*.

The *Somme* springs out of *Picardy*, runs through it, and forsakes not that Province till it lose it self in the Ocean, after it hath washed *Amiens*, *Abbeville*, and several other Towns of that Country, from whence the *Escaut*, or *Scheld*, springs also.

The *Aude* comes from the *Pyrenean* Mountains, and runs by *Carcassonne* and *Narbonne*.

The

The *Erand* comes from the *Sevenes*, and passes by *Agde*, the *Orb* by *Beziers*,

The *Rhosne* has its source in Mount St. *Gothard* among the *Alpes*, runs through the Lake of *Geneva*, passes by *Lyons*, *Vienne*, *Valence*, under the *Pont* St. *Esprit*, by *Avignon*, *Beaucaire*, *Arles* and receives into it the *Saone*, the *Isére*, the *Droume*, the *Durance*, the *Ardeche*, the *Gardon*; and by its Branches having made an Island which is called *Camargue*, (from *Cajus Marius*, corrupting *Caii Marii Ager*, into *Camargue*,) it falls into the *Mediterranean*

There are in *France* fifteen Archbishopricks, and comprehending *Avignon*, sixteen, which are *Rouen*, *Tours*, *Bourdeaux*, *Auch*, *Thoulouze*, *Narbonne*, *Arles*, *Aix*, *Ambrun*, *Vienne*, *Lyons*, *Sens*, *Rheims*, *Paris*, *Bourges* and *Avignon*, and above an hundred Bishopricks.

There are ten ancient Parliaments which are established at *Paris*, *Rouen*, *Rennes*, *Bourdeaux*, *Pau*, *Thoulouze*, *Aix*, *Grenoble*, *Dijon* and *Metz*, and two new ones, the one at *Tournay* for the *French* Conquests in the *Netherlands*, the other at *Besancon* for the *Franche Comty*.

Its Isles in the Ocean are *Belle-Isle*, on the Coast of *Bretaign*; *Noirmousteir* on the Coast of *Poitou*; the Isles of *Re* and *Oleron* on the Coasts of *Aunis* and *Xaintonge*: In the *Mediterranean* are the Isles of *Hieres*, of St. *Margaret*, and St. *Honorat* on the Coast of *Provence*.

Its Mountains besides the *Alpes* and *Pyrenees*, are those of *Auvergne* and *Sevenes*, which the Ancients called *Montes Cebennæ*, the name not much as yet altered.

There are besides, *Mount Jura*, or St. *Claude*, which is towards *Switzerland*, and *Mount Vogesé*, or *Faucilles*, towards the Diocess of *Langres*.

The Catholick Religion is the publick established Religion in *France*, yet the Protestant is permitted there: And thus, Reader, you have a short draught of a large and flourishing Kingdom, under the Dominion of a great and powerful Prince.

Before we proceed to *Italy*, we must pass over into *Savoy*, which is inclosed within *France*: This Dutchy belonging to a Prince who carries the Title of it, hath to the North the Lake of *Geneva* and *Switzerland*, to the East *Piemont*, and *Dauphine* to the South and West; the chief Towns of it are *Chambrey* its Capital City, *Montmelian* and *Foussigny*. The County of *Morienne*, where St. *John* stands, and the *Tarantaise*, where *Monstier* is, which are in the *Alpes*, belong to the Duke of *Savoy*, as well as *Piemont*, and the *Marquisat* of *Saluces*, of which we shall speak in the Description of *Italy*. *Geneva* lying at the end of a great Lake that carries its name, heretofore belonged to the Duke of *Savoy*, but at present it owns no Superior, and is erected into a Commonwealth.

A

A Table of the Longitudes and Latitudes of the principal places in the Kingdom of *France*.

In *Picardy*.

	Lat.		Long.	
Calais.	51	1	23	1
Bologne.	50	5	23	1
Abbeville.	50	1	23	1
Amiens.	49	5	23	4
St. *Quintin.*	50	0	25	1
Perone.	50	0	24	4
Oyk.	49	4	24	3

In *Normandy*.

Rouen.	49	3	22	1
Diepe.	50	0	22	1
Havre de Grace.	49	4	21	1
Lizeux.	48	5	21	4
Caen.	49	2	20	1
Isigny.	49	4	19	1
Auranches.	48	5	19	0
Seez.	48	5	20	5
Isle of *Jersey.*	49	3	18	1
Isle of *Gernsey.*	49	4	17	4

In *Poictou*.

Poictiers.	46	4	21	0
Vivonne.	46	3	21	0
Rochel.	46	1	19	1
Isle of *Re.*	46	1	18	4
Amboise.	47	2	22	0
Guerot.	46	0	23	0

In the Isle *de France*.

Paris.	48	5	23	3
Soyssons.	49	3	24	3
Fountainbleau.	48	3	23	3

In *Champaign*.

Sedan.	49	5	26	1
Rheimes.	49	2	25	2
Espernay.	49	0	25	0
Chalons.	48	4	25	5
Troyes.	48	2	25	2

	Lat.		Long.	
Bray.	48	3	24	2
Ay.	49	0	25	2

In *Bretagne*.

St. *Malo.*	48	5	18	0
Dol.	48	4	18	3
Rennes.	48	0	18	3
Treguier.	48	4	16	4
Morlaix.	48	2	16	0
St. *Pol de Lion.*	48	4	15	4
Brest.	48	0	15	2
Pol David.	47	4	15	2
Blauet.	47	3	16	4
Vennes.	47	2	17	1
Nantes.	47	1	18	5
Machecour.	46	5	18	3
Dieu.	46	4	18	1
Isle *de Nermontier.*	47	0	18	0
Belle Isle.	47	0	16	4
Isle *de Vssant.*	48	1	14	2

In *Main*.

Mans.	48	0	21	0
Suze.	47	5	21	0

In *Anjou*.

Angers.	47	3	19	5
Saumer.	47	1	20	2
Bauge.	47	4	20	5
Craon.	47	5	19	2
Tours.	47	2	21	4

In *Perche*.

Nogent Le Retrou.	48	2	21	5

In the *Nivernois*.

Nevers.	46	5	24	1

In the *Orleannois*.

Orleans.	47	4	23	0
Blois.	47	4	22	2

In *Bourgogne.*

	Lat.		Long.	
Dijon.	47	1	26	2
Auxerre.	47	2	24	4
Autun.	46	4	25	2
Chalon.	46	3	26	1
Verdun.	46	4	26	1
Mascon.	46	0	26	0

In *Berry.*

Bourges.	47	0	23	1

In the *Bourbonnois.*

Moulins.	46	1	24	2

In the *Angumois.*

Angoulesme.	45	5	20	5

In *Saintonge.*

Saintes.	45	5	19	4
Broiiage.	45	4	19	1
Isle *de Oleron.*	45	5	18	4

In the *Lionnois.*

Lyon.	45	4	26	2
Rouanne.	45	5	25	1

In *Perigort.*

Perigeux.	45	2	21	3

In *Limosin.*

Limoges.	45	4	22	1

In *Quercy.*

Cahors.	44	2	22	3

In *Auvergne.*

St. Flour.	44	4	24	2
Merceur.	45	0	24	1
Usson.	45	1	24	4
Clermont.	45	3	24	1

In *Rovergne.*

Rodez.	44	1	23	3
Estain.	41	4	23	2
Vabres.	43	4	23	5

In *Gascogny.*

	Lat.		Long.	
Bourdeaux.	44	5	19	2
Bourg.	45	2	19	4
Tour de Cordovan.	45	3	18	5
Cusac.	45	2	20	0
Albret.	44	2	20	2
Aux.	43	4	21	0
Lombes.	43	2	21	2
Dax.	44	0	19	2
Bayonne.	43	4	18	2

In Low *Navar.*

Pau.	43	2	19	4
Tarbe.	43	1	20	3
St. *Bertrant.*	42	5	21	1

In *Languedoc.*

Tholouse.	43	3	21	5
Alby.	43	3	22	3
Castres.	43	2	22	5
Carcasson.	43	0	22	3
Narbone.	42	5	23	4
Bezieres.	43	0	24	0
Montpellier.	43	1	25	1
Nismes.	43	2	25	3
Uses.	43	3	25	3
Viviers.	44	0	26	0

In *Rousillon.*

Perpignan.	42	1	23	3

In *Province.*

Freiuls.	43	0	28	2
Tholon.	42	4	27	4
Marseille.	42	5	26	5
Aix.	43	0	26	5
Arles.	43	0	26	0
Avignon.	43	3	26	1
Orange.	43	4	26	1
Sisteron.	43	5	27	5

In *Daufine.*

Vienne.	45	1	26	4
Grenoble.	44	5	27	2

St.

	Lat.		Long.	
St. *Antoin.*	44	5	26	4
Valence.	44	3	26	3
St. *Paul.*	44	0	26	2
Embrun.	44	3	28	1

A Table of the Longitudes and Latitudes of the principal places in the Dukedom of *Savoy*.

In *Savoy* Proper.

	Lat.		Long.	
Chambery.	45	1	27	3
Montmelian.	45	0	27	4
Beufort.	45	1½	28	1
Aix.	45	2	27	3
Rumilly.	45	3	27	3
Conflens.	45	1	28	0
Miolans.	45	1	27	4
L' Eſchelles.	45	0	27	2

In *Bugey.*

	Lat.		Long.	
St. *Genis de Hoſte.*	45	1	27	1
Yenne.	45	2	27	2

In *Maurienna.*

	Lat.		Long.	
La Chambre.	44	5	28	0
St. *Jean de Maurien.*	44	4	28	0
Modane.	44	4	28	2
Laſneburg.	44	5	28	4
Mount Cenis.	44	4	29	0

In the *Tarantais.*

	Lat.		Long.	
Monſtiers.	45	1	28	1
St. *Jacquieſme*	45	0½	28	2
St. *Maurice.*	45	1	28	3

In the *Genevais.*

	Lat.		Long.	
Geneva.	46	0	27	4
Annecy.	45	4	27	4
Alby.	45	3	27	4
Thonne.	45	3	28	0

In *Fauſigny.*

	Lat.		Long.	
La Bonne Ville.	45	4	27	5
Cluſe.	45	4	28	1
Salanche.	45	3	28	2

In *Chablais.*

	Lat.		Long.	
Thonon.	46	0	28	0½
Ripaille.	46	0	28	1
Evian.	46	0	28	2
St. *Jingo.*	46	0	28	3
Aux.	45	5	28	2

CHAP. VI.

Italy.

ITALY hath on the Weſt the River *Var* and the *Alpes* which divide it from *France*, and the *Mediterranean* Sea; it is divided from *Germany* by the ſame Mountains on the North, on part of which ſide alſo is the Gulf of *Venice*: it hath to the Eaſt the *Ionian* Sea, and to the South the Sea of *Tuſcany*. This Region reſembles the Leg and Thigh of a man, or (if you had rather) a Boot.

The *Apennine* Hills ſtretch along the whole length of it; and it is divided into ſeveral ſtates under the Dominion of divers Princes. The Pope poſſeſſes the

the Ecclesiastick State, in which are the Campania of *Rome*, the Patrimony of St. *Peter*, the Dutchies of *Spoleto*, *Urbin* and *Ferrara* the Mark of *Ancona*, *Romania* and the *Boulognois*: and in the Kingdom of *Naples*, the Dutchy of *Benevent*. The King of *Spain* possesses the Kingdom of *Naples*, the Dutchy of *Milan*, and some places on the side of *Tuscany*, with the Marquisat of *Final*, on the Frontiers of *Genoa*. The Duke of *Florence* is Master of the greatest part of *Tuscany*. The Duke of *Savoy* holds *Piemont*, the Marquisat of *Saluces*, and the County of *Nice*. The Duke of *Parma*, the Dutchies of *Parma* and *Placentia*, and the Dutchy of *Castro*. The Duke of *Mantua*, the Dutchy of *Mantua* and *Montferrat*. The Duke of *Modena*, the Dutchies of *Modena* and *Regio*. The Prince of *Massa* the Principality that gives him the Title. The Prince of *Mirandola*,the Principality of the same name. The Bishop of *Trent* is Prince of his own Bishoprick: it contains four Republicks, two that are great, to wit, of *Venice* and *Genoa*, and two lesser, of *Lucca* and St. *Marin*. The Republick of *Venice* possesses part of *Istria*, (the rest belonging to the House of *Austria*) *Frioli*, the Mark *Trevisane, il Dogado*, the *Paduan*, the *Veronese*, the *Vicentin*, the *Bressian*, and the *Bergamaske*. The Republick of *Genoa* possesses that which is called *Riviera di Genoa*; that of *Lucca* but little, and that of St. *Marin* less. We are now to take a view of of all these States in order, Coasting along by the Sea which environs that sweet Country, and proceeding from West to East.

Having passed the *Var*, we come into the County of *Nice*, wherein is a City of the same name, and that of *Villa Franca*.

Monaco which belongs to its own Prince; the Marquisat of *Final* with a Town of the same name.

The *Riviera de Genoa*, wherein are the Metropolis of *Genoa*, (which is called in *Italian*, *La Superba*, the Stately, and is one of the most beautiful Towns in *Italy*,) *Savona*, *Albenga*, and some others.

Tuscany is separated from the *Riviera de Genoa* by *La Macra*; it reaches to the Campania of *Rome* on the East, and has that Sea which carries its name on the South, and the *Apennines* on the North. The Duke of *Florence* who takes the Title of great Duke of *Tuscany*, is Master of the greatest part of it. The chief Towns in his Territories are *Florence*, the Capital City, *Pisa*, *Siena*, *Volterra*, *Pistoia*, and *Legorn*, a Sea-Port Town. The small State of the Republick of *Lucca*, the Principality of *Massa*, and the *Stato delli Presidi*, in which are the Towns *Orbitello*, *Porto Hercole*, and *Piombino*, that belong to the King of *Spain*, are in *Tuscany*; as also the Dutchy of *Castro*, which belongs to the Duke of *Parma*, having a Town of the same name, and the Patrimony of St *Peter*, wherein are *Viterbo*, *Montefiascone*, and some others: *Aquapendente*, *Peruga* near a Lake that bears its name. *Orvieta* and *Civita Vecchia*, a fair Port where the Pope keeps his Gallies, are likewise in *Tuscany*.

The Campania of *Rome*, in ancient times called *Latium*, hath to the East *La Terra d' Lavoro* of the Kingdom of *Naples*, to the South, the Sea, to the West *Tuscany*, from which it is separated by the *Tibre*, and to the North *Abruzzo*; its Capital City is *Rome*, so famous that none can compare with it: heretofore it gave Laws to the whole World almost, and at present extends its

its power farther than ever, seeing the Popes exercise their Authority in *America*, where the Consuls and Emperors of *Rome* were never known: There are many prints of its ancient splendor still extant, as the *Pantheon*, which goes by the name of *Santa Maria Rotunda*, the Pillars of *Trajan* and *Antonin*, Amphitheaters, Baths, Aqueducts, and many other stately remains of Antiquity, which by their Ruins publish the *Roman* Magnificence and Grandeur: it stands upon the *Tiber*, at the mouth of which River is the Town of *Ostia*. The other Towns of the Campania of *Rome*, are *Tivoli*, formerly *Tybur*, where are excellent Waters, *Avagnia*, *Palestrine*, which is the ancient *Preneste*, *Veletri*, heretofore *Velitræ*, where Augustus was born, *Terracine*, and some others.

The Kingdom of *Naples* is bounded on the West, by the State of the Church, and on all other sides by the Sea; to wit, the Sea of *Tuscany* on the South, that of *Ionia* on the East, and the Gulf of *Venice* on the North: it is divided into several Provinces; on the *Tuscan* Sea are, *Terra di Lavoro*, of which *Naples* is the Capital City, that hath a good Port, the others are, *Capoua*, *Pussoli*, *Cajette*, and *Baiæ* that is ruined: The Principality wherein *Salerne* is; *Calabria* that contains *Cosenca* and *Regio*. The *Basilicate* and Principality of *Tarento*, lie on the *Ionian* Sea; and on the Gulf of *Venice*, the Country of *Otranto*, that has a Town of the same name, and the Land of *Bari*, in which are *Bari* and *Brindisi*; *Apulia*, wherein is *Manfredonia*; *Abruzzo*, whereof the Capital Town is *Aquila*: And in that Province also is the Dutchy of *Benevento* that belongs to the Church.

The Mark of *Ancona* lies likewise on the Gulf of *Venice*, in which is a Town of the same name, and that of our Lady of *Loretto*, that is much frequented upon the account of Devotion.

Next after comes *Romania*; its Capital City is *Ravenna*, and the others are, *Faensa* *Forli* and *Imola*.

The *Boulognois* has *Bononia* for its Capital, which is one of the fairest Cities of *Italy*: The Dutchy of *Ferrara* with its Metropolis of the same name is Situated on the *Po*.

The Dutchy of *Venice*, wherein is comprehended that delicate City built upon *Piles* in the Sea.

Frioli, where are *Udena*, and the Ruins of *Aquilea*.

Istria, which belongs partly to the *Venetians*, and partly to the Archdukes of *Austria*, bounds *Italy* on that side; the chief Towns of it are, *Cabo d' Istria*, *Tergeste*, *Parentia* and *Pola*.

The Marque, or Mark *Trevisane*, hath *Trevisa*, *Verona* and *Vicensa*.

The Bishoprick of *Trent* stretches along the *Alpes*; and its chief City is famous for the last Council held there: the Bishoprick of *Bellona* is in the same Province also.

The Dutchy of *Milan* hath the *Alpes* on the North, *Piemont* on the West, *Parma* on the South, and the *Venetian* State on the East; *Milan* its Capital, is one of the greatest Towns of *Europe*, and its Castle one of the best Fortresses: in the same Province are also *Pavia*, *Cremona*, *Novarra*, *Lodi*, *Como* and *Vigevano*. The Metropolis of *Piemont*, is *Turin* on the *Po*, a lovely City where

where the Dukes of *Savoy* keep their Court: *Pignerol* a strong place belonging to *France*, is in the same Province. *Carmagnole* is the chief Town of the Marquisat of *Saluces*; as *Casal* is in *Montferrat*.

The Dutchies of *Parma*, *Placentia*, *Modena* and *Regio*, have their Capital Cities of the same names.

The Dutchy of *Mantua* hath likewise a City of the same name, built in the middle of a Lake on the River *Mince*.

These Dutchies that we have now named, lie in that part of *Italy* which the *Romans* called *Gallia Cisalpina*, because the *Gaules* were planted there, and that as to them it was on this side of the *Alpes*; it was afterwards called *Lombardy*, from the *Lombards* that Conquered it, which name it still retains: it is on the South shut up by the *Apennine* Hills, the *Alpes* on the North and West, and by the Gulf of *Venice* and the River *Pisaura*, or *Foglia*, on the East. A great part of the *Venetian* State lies in that Region, as *Crema* a strong Town, *Bergamo* with its Territory, and *Fresse*, or *Brescia*, with its Dependances.

The Dutchy of *Spoleto*, and that of St. *Urbin*, which belongs to the Holy See, have each of them a Capital Town of the same name, and are Situated upon the *Apennine* Mountains in the Center of *Italy*. In the first is the Town of *Assise*, where St. *Francis* was born; within the second is enclosed the little Republick of St. *Marin*, under the Protection of the Pope.

The chief Rivers of *Italy* that fall into the *Mediterranean*, are the *Var*, which runs through the County of *Nice*, and divides it from *Provence*; the *Magra*, which divides *Liguria*, called *Riviera di Genoa*, from *Tuscany*; the *Arne*, that passes by *Florence* and *Pisa*; the *Tiber*, that runs by *Rome*, and is augmented by *Teverone* and *Chiara*; the *Garigliano*, heretofore *Liris*, and the *Vulturno*.

Into the Gulf of *Venice* fall, *Lofanto*, *Pescara*, and *Tronto*, which are in the Kingdom of *Naples*; the *Foglia*, that is in the Mark of *Ancona*.

Rubicon, at present, *Pisatello*, that heretofore divided *Gallia Cisalpina* from the West of *Italy*.

The *Po*, which is the greatest River of *Italy*, and rises in Mount *Viso*, one of the *Alpes*; it passes by *Turin*, and through the Dutchy of *Milan*, goes into the Lands of *Mantua*, and *Ferrara*, and from thence into the Gulf of *Venice*; having swallowed up in its passage the *Doria*, the *Tezin*, the *Ada*, the *Oglio*, the *Mince*, the *Taner*, and several other Rivers.

The *Adige* passes by *Trent* and *Verona*.

The *Brenta* passes by *Padua*.

Tagliamento and *Lizonsa* wash *Friuli*: *Rizano Istria*; and *Arsa* divides it from *Dalmatia*.

There are considerable Lakes in *Italy*: in *Lombardy* is the Lake *Major*, heretofore called *Verbanus*, out of which comes the *Tezin*.

The Lake of *Como*, anciently called *Larius*, out of which comes the *Ada*; the Lake of *Isseo*, whence comes the *Oglia*; the Lake of *Lugano*, and another called *de Garda*, which produces the *Mince*.

In

In *Tuscany* is the Lake *Thrasimene*, at present called the Lake of *Perugia*: the Lake *Vulsin*, now of *Bolsena*, and the Lake of *Braciano*, heretofore *Sabutinus*.

In the Campania of *Rome*, are the Lake *Fucin*, the Lake *Fundi*, and the Lake *Albanus*, now called *Lago di Castello Gandolfo*.

The chief Islands of this Country, are *Elbe*, *Corsica*, *Sardinia*, *Ischia*, *Caprea*, *Sicily*, and some others.

The Isle of *Elbe* is near the Shoar of *Tuscany*: it hath a Town called *Cosmopolis*, and a Mountain of Loadstone: it belongs partly to the great Duke of *Tuscany*, and partly to the King of *Spain*.

Corsica is over against the *Riviera* of *Genoa*, and belongs to that Republick; its chief Town is *La Bastia*, and best Port that of St. *Boniface*.

Sardinia is divided from *Corsica* by an Arm of the Sea, it lies to the South of *Corsica*, and belongs to the King of *Spain*: the chief Town of it is *Calari*, and the others are *Oristagna*, *Sassari* and *Algeri*.

Near to *Naples* is the Isle of *Ischia*, with a Fort of the same name, and *Caprea*, famous for the Residence of *Tiberius*, is likewise [illegible]

Sicily is the greatest Island of the *Mediterranean*, it [illegible] d from *Italy*, (to which it is thought to have been anciently [illegible] narrow Branch of the Sea, called the *Fare* of *Messina*; the chief [illegible] of it are *Palermo*; its Capital, the Residence of the Viceroy, *Messina*, *Trepano*, *Girgenti* *Syracusa*, and *Catanea*, near to which is the famous Mount *Ætna* that vomiteth out fire, called at present Mount *Gibello*: this Island belongs to the King of *Spain*.

The Isles of *Lipare* are not far from this, some of which cast out Fire.

In the Gulf of *Venice*, and near to Mount *Gargan*, are the Isles of *Diomedes*, at present of *Sancta Maria del Trinita*.

The Mountains of *Italy* are the *Alpes* that limit it, and the *Apennine* Hills that run through it. Not far from *Naples* is Mount *Vesuvius*, which hath often cast out Fire, but not at present, it is now called *Monte di Sommo*, and produces excellent Wine. In *Apulia* is Mount *Gargan*, now *di Santo Angelo*.

There is no Religion but the Roman Catholick professed in *Italy*: and the least Towns of it are Bishopricks.

A Table of the Longitudes and Latitudes of the Principal Places in the Territories of *Italy*.

	Lat.		*Long.*			*Lat.*		*Long.*	
1. In the Kingdom of *Naples*.					*Matera*	40	4	41	0
Regio	37	5	40	1	*Taranto*	40	3	41	3
Cape *Spartivento*	37	4	40	4	*Otranto*	40	1	42	2
St. *Severina*	39	1	41	1	*Brindisi*	40	4	42	1
Cosensa	39	3	40	3	*Bari*	41	2	40	4
Policastro	40	0	39	2	*Benevent*	41	1	38	5
Salerno	40	4	38	5	*Manfredonia*	41	4	39	4
Gallipoli	40	1	42	1	*Naples*	40	5	38	4
Cirenza	40	4	40	1	*Aversa*	41	0	38	1

	Lat.	Long.
Capua	41 1	38 2
Gaetta	41 2	37 3
Boiano	41 4	38 2
Pescara	42 4	38 1
Chietta	42 3	38 1

2. In the Estate of the Church.

	Lat.	Long.
Rome	41 4	36 3
Ostia	41 3	36 5
Mont Fiascone	42 0	35 4
Bracciano	41 4	36 0
Civita Vecchia	41 3	35 4
Orvietta	42 1	36 0
Perugia	42 4	35 2
Spaletto	42 4	36 1
Narni	42 2	36 2
Fermo	43 0	37 1
Ancona	43 3	36 5
Loretto	43 2	37 0
Urbino	43 3	35 3
Fano	43 4	35 5
Cagli	43 1	35 5
Ravenna	44 0	34 5
Rimini	43 5	35 1
Ferrara	44 4	33 4
Bolognia	44 0	34 0

3. In the Dukedom of *Florence*.

	Lat.	Long.
Florence	43 0	34 2
Pistoya	43 1	34 0
Scarpeia	43 3	34 2
Lucca	43 0	33 3
Pisa	42 4	33 1
Legorn	42 3	33 2
Siena	42 4	34 3
Pienza	42 2	35 0
Piombino Port	41 5	33 4
Orbitello	41 3	35 0
Port *Hercule*	41 2	35 0
Massa	42 1	34 1

4. In the Estate of *Venice*.

	Lat.	Long.
Venice	45 2	34 4
Adria	45 0	34 3
Padova	45 2	34 1
Verona	45 1	33 1
Garda	45 2	32 5
Brescia	45 1	32 2
Isseo	45 0	32 0
Bergama	45 2	31 4
Palma Nova	46 1	35 1
Trevise	45 5	34 2
Feltre	46 1	34 0
Vicensa	45 4	33 5
Trieste	46 0	36 4
Citta Nova	45 1	36 3
Pola	44 5	37 0
Zara	44 3	39 1
Sebenico	44 3	39 5
Spalatta	44 0	40 2
Narenza	44 0	42 0

The Isles.

	Lat.	Long.
Corfu	38 4	44 4
Cefalonia	36 5	46 3
Zant	36 2	46 4

5. In *Piedmont*.

	Lat.	Long.
Turin	44 2	29 4
Susa	44 4	29 0
Aste	44 0	30 2
Nice	42 5	29 2
Inurea	44 4	29 5
Aosta	45 2	29 1
Monaco	42 5	29 4
Pignerol	44 0	29 1
Chier	44 1	30 0
Fossano	43 4	29 5
Oneglia	43 0	30 1

In *Montferrat*.

	Lat.	Long.
Casal	44 2	30 3

6. In the Dukedom of *Milan*.

	Lat.	Long.
Milan	44 5	30 5
Pavia	44 3	31 0
Como	45 1	31 0
Novara	44 5	30 3
Lodi	44 5	31 4
Bobbio	43 5	31 4

Tortona

	Lat.	Long.
Tortona	44 0	31 0
Ugogna	45 3	30 0

7. In the Estate of *Genua*.

	Lat.	Long.
Cape *de Melli*	42 5	30 1
Final	43 2	30 3
Genua	43 3	31 0
Lavagne	43 2	31 4

8. In the Dutchy of *Modena*.

	Lat.	Long.
Modena	44 0	33 4
Reggio	44 0	33 0

9. In the Dutchy of *Mantua*.

	Lat.	Long.
Mantua	44 5	33 1
Ustiano	44 5	32 3

10. In the Dutchy of *Parma*.

	Lat.	Long.
Parma	44 0	32 4
Foronovo	43 5	32 3
Placenza	44 1	31 5

In the Kingdom of *Sicily*.

	Lat.	Long.
Faro	38 0	39 5
Messina	37 5	39 5
Termini	37 1	37 3
Catania	37 0	39 2
Augusta	36 4	39 2
Syracusa	36 2	39 2
Nota	35 5	39 1
Cape *Passaro*	35 4	39 4
Agrigento or *Girgenti*	36 1	37 4
Mazara	36 3	36 2
Trapano	36 5	36 0
Marsala	36 4	36 0
Palermo	37 2	37 0
Milazzo	38 0	39 2

Isles of *Lipari*.

	Lat.	Long.
Stromboli	38 4	39 1
Felicur	38 0	37 5
Lipari	38 2	38 5
Volcano	38 1	38 4
Alicur	38 0	37 3
Ustica	38 0	36 4

In the Island of *Sardinia*.

	Lat.	Long.
Cagliari	37 5	32 2
Sarda	39 2	33 1
Sassari	39 2	31 4
Algeri	39 0	31 4
Oristagni	38 2	31 3
Villa de Iglesia	37 3	31 5

In the Island of *Corsica*.

	Lat.	Long.
Bonifacio	40 0	32 3
Aleria	41 0	32 3
Bastie	41 3	32 2
Cape *Corso*	41 5	32 2
Calvi	41 1	32 0
Ajazzo	40 3	30 2
Genarca	41 0	31 4
Isle of *Elba*	41 4	33 3
Isle *Gorgona*	42 2	32 4

CHAP. VII.

The Low-Countries.

BEFORE we paſs into *Germany*, we muſt view the *Low Countries*, becauſe they lie between it and *France*. They have *Germany* to the Eaſt and North, the Ocean to the Weſt, and *France* to the South. They are divided into ſeventeen Provinces, to wit, four Dutchies, ſeven Counties, five Signiories or Lordſhips, and the Marquiſat of the holy Empire. The Dutchies are *Brabant*, the Capital of which is *Bruſſels*, the Reſidence of the Governours of the *Low-Countries* for the King of *Spain*; its other Towns are *Louvain*, *Antwerp*, *Boiſleduc*, and many others.

The Dutchy of *Limbourg*, which hath a Capital of the ſame name.

The Dutchy of *Luxembourg* which hath its principal Town of the ſame name alſo: its other conſiderable Towns are *Arlon*, *Thionville*, *Danvilliers* and *Montmedy*.

The Dutchy of *Gueldres* that hath a Town likewiſe of the ſame name, and *Nimeguen* a place of importance.

The County of *Flanders* hath *Ghent* for its Capital; the other conſiderable Towns are *Bruges*, *Ipre*, *Courtray*, and (upon the Sea) *Sluſe*, *Newport*, *Oſtend*, *Dunkirk* and *Graveline*; which two laſt belong to the Crown of *France*.

The County of *Artois* hath *Arras* for Capital, belonging likewiſe to *France*, the other Towns are *Beaupaume*, *Bethune*, and St. *Omer*, taken in the late Wars by the *French*.

The County of *Hainault* has *Mons* for Capital, *Valenciennes*, *Bouchain*, *Mariembourg* and *Landrecy*.

The County of *Namur* hath its Capital of the ſame name, *Bouvines* and *Charlemont*.

The County of *Zutphen* hath its chief Town of the ſame name alſo: it is comprehended under the Dutchy of *Gueldres*.

The County of *Holland* hath very fair Cities, as *Amſterdam* its chief, *Harlem*, *Leyden*, *Dort*, *Roterdam*, and ſeveral others. The *Hague* is but a Town, yet there the Aſſembly of the States, and Court of the Prince of *Orange* are kept.

The County of *Zealand* is compoſed of ſeveral Iſles, made by the branches of the *Eſcaut*, or *Scheld*; the chief is the Iſle of *Walkeren*, in which are the Towns of *Middleburg* and *Fluſhing*.

The Marquiſat of the Holy Empire is no more but the City and Territory of *Antwerp*, comprehended under *Brabant*.

The Signiory or Province of *Malines* contains likewiſe only the Town of the ſame name, with its Territory included within *Brabant*.

The Signiory or Province of *Utrecht* hath a large and beautiful Town of the ſame name, and beſides *Rhenen*, *Amersfort*, *Montfort* and *Wik* at *Duerſtede*.

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The Signiory or Province of *Over Issel* is so called, because in respect of the other Provinces of the *Low-Countries*, it is on the other side of the *Issel*, which is a branch of the *Rhine*, and is by the Latins called *Transissulana*: its Towns are *Deventer*, *Swoll*, *Campen*, *Steenwick*, *Cowerden*, and *Oldenzeel*.

The Signiory or Province of *West-Friesland* hath these remarkable Towns, *Lewarden*, *Dockum*, *Franiker*, *Staveren*, and *Harlingen*.

The Signiory or Province of *Groningen*, hath the Town which gives it its name, and another small Town called *Dam*.

The *Low-Countries* are watered with pleasant Rivers, which are the *Scheld*, the *Meuse*, and the *Rhine*; the *Scheld* hath its Source in *Picardy*, passes by *Valenciennes*, *Tournay*, *Ghent* and *Antwerp*; and having embraced the Isles of *Zealand*, and received the supplies of the *Lys*, the *Lieue*, the *Dender*, the *Rupel*, and some other Rivers, it falls into the Ocean.

The *Meuse* cometh from the Mount of *Vauge* in the Diocess of *Langres*, passes by *Charlemont*, *Bouvines*, *Namur*, *Maestricht*, *Grave*, and joyning with the *Wahal*, one of the Branches of the *Rhine*, it receives the *Sambre* and some other Rivers.

We shall speak of the *Rhine* when we treat of *Germany*.

The nineteen Provinces, or *Low-Countries*, falling to the Crown of *Spain* by *Mary*, Heiress of the House of *Burgundy*, some of them Revolted, and erected themselves into a Commonwealth, by the name of the States of the United Provinces, commonly called the States of *Holland*: they are composed of *Holland*, *Zealand*, *Utrecht*, *Over-Issel*, *West Friesland*, *Groningen*, *Gueldres*, and *Zutphen*. The Assembly of the States General is held at the *Hague*, and since their settlement, the Princes of *Orange* have been the Generals of their Armies. *Calvins* Reformation is the Religion publickly established; but the *Catholick*, *Lutheran*, *Anabaptist*, *Socinian*, and many other Religions are tolerated there.

The *French* in the late Wars Conquered many considerable places of the *Spanish Netherlands*, some of which have been made over to that Crown, by the *Spaniard*, in the last Treaty of Peace concluded at *Nimeguen*; so that the *Spanish* Interest in these Provinces is at present much impaired and weakened.

Before we proceed further, it is to be observed, that the *Cambresis* and Bishoprick of *Liege* are inclosed within the *Low Countries*.

The *Cambresis* lies between *Artois* and *Hainault*, and hath *Picardy* to the South: the City of *Cambray* that gives it the name is a spacious and fair Town, belonging now to the *French* King.

The Bishoprick of *Leige* hath to the North and West *Brabant*, *Luxemburg* on the South, and *Limbourg* on the East. The City of *Leige* is very fair and spacious, lying on the *Meuse*; the Bishop of it is Soveraign Prince of all his Diocess, which comprehends the Dutchy of *Bouillon*, the Towns of *Masiyk* and *Tongres*, with the Burrough of *Spa* famous for its Medicinal Waters.

A Table

A Table of the Longitudes and Latitudes of the principal places in the *Netherlands.*

In the *French* Conquests in *Artois.*

	Lat.	Long.
Arras	50 1	23 5
Lens	50 3	24 0
Bethune	50 4	23 5
St. *Pol*	50 2	23 3
Bapaumes	50 1	24 0
Pas	50 1	23 4
Renti	50 4	23 1
Hesdin	50 2	23 1
Teroane	50 4	23 2
Lillers	50 4	23 4
St. *Omers*	50 5	23 2
Ayre	50 4	23 4
St. *Venant*	50 4	23 5

In *Flanders.*

	Lat.	Long.
Graveling	51 1	23 1
Bourbourg	51 0	23 1
Mardyke	51 1	23 2
Dunkirk	51 1	23 3
Winoxberg	51 0	23 3
Mont-Cassel	50 5	23 4
Armentiers	50 4	24 0
Furnes	51 1	23 5
Ipre	51 0	24 1
Poperingen	51 0	23 5
Belle	50 5	24 0
Warneton	50 5	24 1
Conimes	50 5	24 2
Warwick	50 5	24 2
Menin	50 5	24 3
Lille	50 4	24 2
Le Bassee	50 3	24 0
Orchies	50 3	24 3
Tournay	50 4	24 4
Dovay	50 2	24 2
St. *Amand*	50 3	24 4

In *Hannault.*

	Lat.	Long.
Conde	50 3	25 0
Valenciennes	50 2	24 5
Bouchain	50 1	24 3
Bavay	50 2	25 1
Maubeuge	50 2	25 2
Chymay	50 0	25 4
Avesnes	50 1	25 2
Quesnoy	50 2	25 0
Landrecy	50 1	25 0
Philipville	50 2	25 5
Mariembourg	50 1	25 5

In the County of *Namour.*

	Lat.	Long.
Charlemont	50 1	26 1
Buillon	50 0	26 3
Cambrey	50 1	24 3
Chasteau Cambresis	50 0	24 5
Creveceur	50 0	24 3

In the Dukedom of *Luxembourg.*

	Lat.	Long.
Thionville	49 3	27 4
Montmedy	49 3	26 5
Marville	49 3	27 0

In the *Spanish Flanders.*

	Lat.	Long.
Newport	51 2	24 0
Dixmude	51 1	24 0
Ostend	51 2	24 1
Bruges	51 2	24 2
Courtray	50 5	24 3
Gaunt	51 1	25 0
Damm	51 2	24 2
Blankemburg	51 3	24 2
Dendermond	51 1	25 3
Rupelmond	51 2	25 3
Alost	51 0	25 3
Oudenard	51 0	25 0

In *Brabant.*

	Lat.	Long.
Brussels	50 5	25 4
Vilvorden	51 0	25 5
Malines, or *Mechlin*	51 1	25 5

Antwerp

	Lat.	Long.
Antwerp	51 2	25 4
Lovain	51 0	26 0
Nivelle	50 4	25 4
Gembloures	50 4	26 0
Judoign	50 4	26 2
Tillemont	50 5	26 2
Lewe	51 0	26 3
Deist	51 1	26 2
Arscott	51 1	26 1
Herentals	51 2	26 2
Lire	51 2	26 0

In *Hannault.*

	Lat.	Long.
Hall	50 5	25 4
Enghien	50 5	25 2
Brain le Comte	50 4	25 3
Mons	50 3	25 2
St. *Guislain*	50 3	25 1
Binch	50 3	25 3
Ath	50 5	25 1
Ligne	50 4	25 0

In *Namour.*

	Lat.	Long.
Namour	50 3	26 2
Bovines	50 2	26 1
Charleroy	50 3	25 5

In the Dutchy of *Limburg.*

	Lat.	Long.
Limburg	50 4	27 3
Mastricht	51 0	27 1

In the Dutchy of *Luxembourg.*

	Lat.	Long.
Luxembourg	49 4	27 4
Arlon	49 5	27 2
Newchâtel	49 5	26 5
Marche	50 2	26 5
La Roche	50 2	27 1
Bastoygne	50 0	27 2

In the Country of *Leige.*

	Lat.	Long.
Leige	50 4	27 0
Huy	50 4	26 4
Dinant	50 2	26 2
St. *Hubert*	50 1	26 5
St. *Truyen*	50 5	26 3
Tongres	50 5	26 5
Visett	50 5	27 1
Hassalt	51 0	26 4
Maseyck	51 1	27 1

In the Estates of the United Provinces in *Flanders.*

	Lat.	Long.
Cadsant	51 3	24 4
Hulste	51 2	25 2
Sas de Gaunt	51 2	25 0
Lillo	51 3	25 3
Sluce	51 2	24 4

In *Brabant.*

	Lat.	Long.
Bergen op Zoam	51 3	25 3
Breda	51 4	26 0
Bois le duc	51 4	26 3
Ravestein	51 5	26 5
Grave	51 5	27 0

In *Zeeland.*

	Lat.	Long.
Middlebourg	51 3½	24 5
Flussing	51 3	24 5
Helveet sluce	51 5	25 2
Brewers haven	51 4	25 0
Brille	52 0	25 1
Tolen	51 4	25 2
Somerdikel	51 5	25 2
Goree	51 5	25 1

In the Earldom of *Holland.*

	Lat.	Long.
Amsterdam	52 3	26 0
Harlem	52 3	25 4
Leyden	52 1	25 4
Hague	52 1	25 2
Delft	52 0½	25 2
Rotterdam	52 0	25 4
Dort	51 5	25 5
Gouda	52 1	25 5
Gorcum	51 5	26 1
Heusden	51 5	26 2
Gertrudenburg	51 4	26 0
Muyden	52 2	26 1
Narden	52 2	26 3

In

In *North Holland.*

	Lat.	Long.
Alkmaer	52 5	25 5
Medenblick	52 5	26 2
Enkhusen	52 5	26 3
Horn	52 5	26 1
Edam	52 4	26 1
Monikidam	52 3½	26 1

In *West-Friesland.*

Lewarden	53 2	27 0
Dockum	53 3	27 1
Staveren	53 1	26 4
Harlingen	53 2	26 4
Franiker	53 2	26 5
Bolsvart	53 1½	26 5

In the Lordship of *Croningen.*

Groningen	53 2	27 5
Damm	53 3	28 0
Delfzeil	53 3	28 1

In the Lordship of *Utrecht.*

Utrecht	52 1	26 2
Amersfort	52 2	26 4

In the Province of *Over-Issel.*

	Lat.	Long.
Deventer	52 3	27 3
Zowll	52 4½	27 2
Campen	52 4	27 1
Cowerden	53 0	28 0
Oldenzeel	52 3	28 2
Steenwick	53 0	27 2
Meppel	52 5	27 3

In the Dutchy of *Gueldres.*

Harderwick	52 3	26 5
Hattem	52 4	27 1
Arnheim	52 0½	27 0
Scenksconse	51 5½	27 2
Bommel	51 5	26 3
Tiel	51 5½	26 4
Nimeguen	52 0	27 0
Grave	51 5	27 0
Gueldres	51 3	27 4
Venlo	51 2	27 3
Genep	51 5	27 1

In the Earldom of *Zutphen.*

Zutphen	52 2	27 3
Doesburg	52 1	27 3
Borkelo	52 2	28 0
Groll	52 1	28 0
Brefort	52 0	27 5
Iselbourg	51 5	27 5

The Islands adjoyning.

The *Texel*	53 1½	26 0
The *Vlie*	53 3	26 1
Schelling	53 3½	26 3
Ameland	53 4	27 0

CHAP. VIII.

Germany.

GErmany has on the East side *Prussia*, *Poland*, and *Hungary*; the *Baltick* Sea, *Denmark*, and Ocean on the North; on the West the *Low-Countries* and *France*, and the *Alps*, which divide it from *Italy*, on the South. On the *Baltick* Sea are *Pomerania*, whereof *Stetin* is the Capital City, and *Gripsuald* and *Colberg* two others: The Dutchy of *Meckelbourg*, whereof the chief City is *Swerin*.

Upon

Upon the Ocean are the Dutchy of *Holsace* or *Holstein*, in which are *Hambourg* and *Lubeck*.

The County of *Emden*, called otherways *East-Friesland*, to distinguish it from that whereof we spoke in the *Low-Countries*; its chief Town carries also the name of *Emden*: it has likewise another Town called *Aurich*.

Along the *Rhine* upwards lies *Westphalia*, whereof the most remarkable Towns are, *Munster*, *Paderborne*, *Soest*, *Ereme*, *Oldembourg* the Capital of a County of the same name.

The Diocesses of *Cologne*, *Mayence*, and *Treves*, with their Metropolitan Cities of the same name; the *Palatinate* of the *Rhine*, whereof *Heidelberg* is the Capital City; the Dutchy of *Baden*; the Diocesses of *Worms* and *Spire*. High and Low *Alsace*; *Strasbourg* is the chief City of this, and *Frisac* and *Fribourg* are the chief Towns of the other, which is one of the last Conquests of *France*.

At the head of the *Rhine*, and in the *Alps*, are the *Swisses*, divided into thirteen Cantons, *Zurich*, *Berne*, *Lucerne*, *Basle*, *Schaffhouzen*, *Fribourg*, *Zug*, *Glaris*, *Switz*, *Appenzel*, *Solcurre*, *Vnderwald* and *Vri*, this last hath no Towns, but *Altorf* is its chief *Burrough*: all the other Cantons have their names from their Capital Cities, and from that of *Switz* the people are called *Switzers*, and the Country *Switzerland*.

The Country of *Valois* lies along the *Rhosne*, and its chief City is *Syon*, the Bishop whereof is a Temporal Lord.

The *Grisons* are united with the *Swisses*, and *Coire* is their Capital City: Along the *Danube* are *Suabia*, which comprehends the Dutchy of *Wittemberg*, the chief Towns whereof are *Tubinge* and *Stutgard*: in *Suabia*, properly so called, are *Ausbourg*, *Vlme* and *Nordlingen*.

The Dutchy of *Bavaria*, whereof the Capital is *Munich*; the other Cities are *Saltsbourg*, *Ratisbonne* and *Ingolstat*: and in the *Palatinat* of *Bavaria*, *Amberg* its Capital, and *Nuremberg*, an Imperial City.

The Arch-Dutchy of *Austria* is to the East of *Bavaria*; its Metropolis is *Vienna*, the usual Residence of the Emperor. The County of *Tirol* is to the South of *Bavaria*, it hath a City of the same name, but *Inspruck* is the Capital thereof.

Stiria hath *Grats*; *Carinthia* hath St. *Veit* and *Villach*; and *Carniola*, *Laubach* for its Capital: these Provinces, as well as the County of *Tirol*, belong to the Arch-Dukes of *Austria*, and lie Southward of that Arch-Dutchy.

Then going from South to North, beyond *Austria*, lie *Moravia*, with *Olmutz* its Capital City.

Silesia, that hath *Vratslavia*, commonly called *Breslau*, for its Metropolis.

The Marquisat of *Brandenbourg*, divided into two Marches, the ancient, in which is *Brandenbourg*, and the new, wherein is *Francfort* upon the *Oder*, which are their Capitals; but the Residence of their Prince is commonly at *Berlin*.

Saxony is in the heart of *Germany*, divided into the Upper, where is *Wittemberg*, and the Lower, wherein is *Hall*.

The Dutchies of *Brunswick* and *Lunenbourg*, are comprehended in the lower *Saxony*, with the Cities of the same name.

The Marquisat of *Misnia*, wherein *Dresden* and *Leipsick* are; and the County of *Mansfield*, with its Capital of the same name, are in lower *Saxony* also.

Turinge, a Lantgraviat, hath for Capital *Erfurt*, which is the greatest City in *Germany*, and another Town called *Jena*.

The Lantgraviat of *Hesse*, hath *Cassel* and *Marpurg*.

The Dutchy of *Franconia* hath for Metropolis *Wirtzbourg*; its other chief Towns are *Bamberg*, and *Francfort* on the *Main*, where the Emperor is chosen.

The Kingdom of *Bohemia* is almost in the middle of *Germany*, and its Capital City is *Prague*.

The chief Rivers of *Germany* are the *Rhine*, the *Ems*, the *Weser*, and the *Elbe*, which discharge themselves in the Ocean; the *Oder* in the *Baltick*, and the *Danube* in the *Euxine* Seas.

The *Rhine* cometh from the *Alpes*, and hath its Source in the Mount Saint *Gotard*, from whence the *Rhosne* and *Tesin* spring also; it runs through *Switzerland* and the Lake of *Constance*, passeth by *Schaffousen* and *Basle*, continues its course through *Alsace*, by *Brisac*, *Strasbourg*, *Spire* and *Wormes*: through the palatinate, by *Mayence* and *Cologne*; and having sent out several Branches, and received the *Moselle* that passeth by *Treves*, the *Neckar*, that passeth by *Heidelberg*, and the *Main* that joyns it at *Mayence*: one of its Branches called the *Mahal* mingling with the *Meuse*, at length in *Holland* it loseth it self in the Sea.

The *Ems* runs through *Frieseland*, and passeth by the Town of *Emdem*: the *Weser* watereth *Westphalia*, and passes near to *Breme*.

The *Elbe* hath its Fountains in *Bohemia*, aud runs through both *Saxonies* and the Dutchy of *Holstein*, and having washed *Hamburg*, and received the *Molda* that runs by *Prague*; the *Sal*, the *Spree*, and some other Rivers, it falleth into the Ocean.

The *Oder* passes by *Francfort* and *Stetin*, and empties it self into the *Baltick* Sea.

The *Danube* riseth in the Dutchy of *Witemberg*, passeth through *Suabia*, *Bavaria*, *Austria*, *Hungary*, *Servia*, *Bulgaria*, and by several mouths it discharges it self into the *Black* Sea; after that it hath watered *Ulme*, *Ratisbonne*, *Vienna*, and received in a great many other Rivers, the chief whereof are the *Jun*, the *Drave*, the *Save* and the *Tibisque*.

There are but six Archbishops in *Germany*, to wit, the three Electors of *Mayence*, *Cologne* and *Treves*; the Archbishops of *Magdebourg*, *Breme* and *Saltzbourg*; there are in *Germany*, free and Imperial Cities, and the *Hans* Towns for Commerce: the States of the Empire, which are called Diets, meet usually at *Ratisbonne*. The Emperor is head of the Empire, he is chosen at *Francfort*, and has his usual Residence at *Vienna*: he is Catholick, but several Princes of the Empire are Calvinists, and others Lutherans.

There

There were in former times but seven Electors, three Ecclesiastick, who are the Archbishops of *Mayence*, *Cologn*, and *Treves*; the Duke of *Saxony*, the Marquess of *Brandebourg*, the Count Palatine, and the King of *Bohemia*: but the Juncture of times hath occasioned the addition of an eighth, who is the Duke of *Bavaria*.

A Table of the Longitudes and Latitudes of the principal Cities and Towns of *Germany*.

	Lat.	Long.
In *Austria*.		
Vienna	48 2	39 2
Lintz	48 2	36 3
Ens	48 1	36 4
Losenstein	48 0	37 1
In *Tyrol*.		
Inspruck	47 0	33 4
Landeck	46 3	32 4
In *Carinthia*.		
St. *Veit*	47 0	37 0
In *Styria*.		
Gratz	47 1	39 0
Pettaw	46 4	39 2
Sekow	47 3	37 5
In *Carniola*.		
Lawbach	46 2	37 2
In *Bohemia*.		
Prague	50 0	36 4
Konigin-gratz	50 0	38 1
Klataw	49 3	36 0
Satz	50 1	35 3
In *Moravia*.		
Olmutz	49 4	39 2
Brinn	49 1	38 5
In *Silesia*.		
Teschen	49 4	41 0
Oppelen	50 2	40 3
Breslaw	51 0	39 2
Namslaw	51 0	40 2
Glogaw	51 4	38 2
In *Brandenbourg*.		
Frankfort a. Oder	52 2	37 0
Landsberg	52 5	38 3
Kustrin	52 3	37 3
Berlin	52 4	36 0
Steindel	52 5	34 1
Havelburg	52 5	34 4
In *Mecklemburg*.		
Lubeck	54 1	32 3
Wismar	54 1	33 5
Rostock	54 1	34 5
Gustrow	54 0	34 5
In *Pomerania*.		
Bergen in *J. Rugen*	54 2	36 3
Stralsund	54 1	36 0
Stetin	53 2	37 2
Dam	53 3	37 2
Stargard	53 1	38 0
Colberg	53 5	38 5
In *Bavaria*.		
Munick	48 0	33 4
Saltzburg	47 5	35 2
Passaw	48 3	35 5
Ratisbon	48 5	34 2
Landshutt	48 2	34 2
Ingolstat	48 4	33 2
Amberg	49 2	34 1
Ulm	48 3	32 1
Norlingen	48 5	32 3

E 2

In

	Lat.	Long.
In *Suabia.*		
Ausburg	48 1	32 4
Eslingen	48 3	30 5
Friburg	47 5	29 2
Brisac	48 0	29 1
Hall	49 1	31 4
Hailbrun	49 0	31 0
In *Alsatia.*		
Hagnenaw	48 4	29 2
Strasbourg	48 3	29 1
In the *Palatinate.*		
Heydelburg	49 2	30 3
Wormes	49 3	30 2
Spire	49 0	29 5
Phillipsburg	49 5	30 0
Treves	49 4	28 0
Mayence	49 4	30 2
In *Franconia.*		
Francfort	49 5	31 0
Henneburg	50 3	32 0
Schwinfort	50 0	32 0
Bamburg	49 5	32 0
Nurenburg	49 3	33 2
Cullembach	50 0	33 5
In *Hassia.*		
Marpurg	50 4	30 2
Fridburg	50 1	30 5
Cassel	51 1	31 1
In *Cologn.*		
Cologn.	50 4	28 2
Bonne	50 3	28 4
In *Cleves.*		
Cleves	51 3	27 2
Juliers	50 4	27 5
Dusseldorp	51 0	28 1
In *Westphalia.*		
Munster	52 0	29 1
Paderborn	51 4	30 3
Osnaburg	52 2	29 4
Embden	53 2	28 4
Norden	53 4	28 3
In *Bremen.*		
Breme	53 2	30 2
Ferden	53 1	31 2
Hamburg	53 4	31 4
Stade	54 0	31 0
In *Lunenburg.*		
Luneburg	53 2	32 2
In *Brunswick.*		
Brunswick	52 4	32 4
Goslar	51 5	32 3
Hildisheim	52 1	31 5
Nyenburg	52 4	31 0
In *Turingia.*		
Erfort	50 5	33 2
In *Saxony.*		
Dresden	51 0	35 5
Leipsick	51 1	34 4
Wittenburg	51 5	35 2
Minden	51 1	33 4
Bretten	51 3	35 3
In *Lusatia.*		
Bautzen	51 1	36 4
Cotbutz	51 4	36 2
Brybutz	51 3	37 5

In the Cantons of *Swisserland.*

	Lat.	Long.
1. In the Canton of *Zurick.*		
Zurick	47 1	30 2
Kiburg	47 1	30 4
Andelfrugen	47 2	30 3

2. In

	Lat.	Long.
2. In the Canton of *Bern.*		
Bern	46 5	29 0
Thun	46 3	29 2
Aarburg	46 5	28 5
3. Canton of *Lucern.*		
Lucern	46 4	30 0
4. Canton of *Uri.*		
Altorf.	46 3	30 3
5. Canton of *Schwitz.*		
Schwitz	46 4	30 2
6. Canton of *Underwald.*		
Stantz	46 3	31 0
7. Canton of *Zug.*		
Zug.	46 5	30 1
8. Canton of *Glaris.*		
Glaris	46 4	30 5
9. Canton of *Basle.*		
Basle	47 3	29 2
10. Canton of *Friburg.*		
Friburg	46 3	28 4
Montenach	46 3	28 3
Gruieres	46 2	28 4
11. Canton of *Soleurre.*		
Soleurre	47 1	29 0
12. Canton of *Schaffbusen.*		
Schaffbusen	47 3	30 3
Stein	47 3	30 4
13. Canton of *Appenzel.*		
Appenzel	46 4	31 2

CHAP. IX.

The Dutchies of Cleves, Juliers, Lorrain, *and the County of* Burgundy.

THE Dutchies of *Cleves* and *Juliers* are Situated between the *Rhine* and the *Meuse*, and might be reckoned amongst the Provinces of *Germany*; that of *Cleves* has a Metropolis of the same name, and other considerable places, as *Santen*, *Calcar*, *Grefbusen* on this side the *Rhine*, and *Duisbourg* and *Embruch* on the other side.

The Dutchy of *Juliers* has its name from the chief City thereof; it hath also *Berge* and *Duern*. *Aix la Chapelle* is in this Dutchy, and there *Charlemaign* kept his usual Residence; it was the seat of his Empire, and the place of his Burial: He Beautified it with many stately Buildings, with a Church Dedicated to the Holy Virgin, that still remains, and a Palace, which in the time of *Charles* the Bald, in the Year eight hundred and eighty one, was by the Fury of the *Normans* reduced to Ashes. It hath Mineral Waters about it, proper for the Cure of several Maladies, from whence it took its Latin name, *Aquisgranum*, the *Germans* call it *Acken*, and a third of it belongs to the Duke of *Juliers*.

The

The Dutchy of *Lorrain* may be reckoned among the Provinces of *France*, being now in the possession of that King; its Capital City is *Nancy*, the other Towns thereof are *Marsal*, Saint *Nicholas*, *Pont a Mouson* and some others: *Mets*, *Toul* and *Verdun* are likewise in *Lorrain*, and belong to the *French* King.

The County of *Burgundy*, called the *Franche-County*, lies to the East of a Dutchy of the same name belonging to *France*; but the County belonged formerly to the King of *Spain*, though lately Conquered by *France*: The chief Towns of it are *Dole*, the Capital, *Bezanson*, an Imperial City, *Vesoul*, *Grez*, *Cromay*, *Salins*, *Arbois*, *Poligny*, *Nozeret* and others. The *Doux* a sweet River, waters that Country, and passes by *Dole*: it afterwards loses it self in the *Saone*, which divides the Dutchy of *Burgundy* from the County.

A Table of the Longitudes and Latitudes of the principal places in the *Franche Comty* and *Lorrain*.

	Lat.		Long.	
In the *Franche County*.				
Besanson	47	1	27	2
Dole	47	0	26	4
Salines	46	5	27	2
St. *Claud*	46	1	27	3
Grey	47	1½	26	4
Vesoul	47	4	27	3
Mont Belliard	47	4	28	2
Lure	47	4	27	5
Poligny	46	4	27	0
Bleterans	46	2½	26	4
Granville	47	2	27	1
In *Lorrain*.				
Nancy	48	5	28	0
St. *Nicholas*	48	4½	28	1
Chaligny	48	4	27	5
Moyen	48	3	28	3
Marsal	49	0	28	4

	Lat.		Long.	
Rosiers or *Salines*	48	4	28	2
Blamont	48	4½	29	0
Remerimont	48	1	28	4
Toul	48	4	27	4
Vaudemont	48	3	27	5
Pont a Mouson	49	0	27	5
Metz	49	2	28	0
Vaudrevauge	49	4	28	4
Sarbruck	49	3	29	0
Nomeny	49	0	27	4
Phaltsburg	48	5	29	2
St. *Dieu*	48	3	29	0
La Mothe	48	1½	27	3
Newchâtel	48	2	27	3
Verdun	49	2	27	1
St. *Michael*	49	0	27	2
Conflans	49	2	27	4
Barleduc	48	5	26	5
Espinal	48	2	28	3
Sarbourg.	48	5	29	0

CHAP.

CHAP. X.

Hungary.

THE Kingdom of *Hungary* hath *Transilvania* on the East, *Poland* on the North, on the West *Moravia*, *Austria*, and *Stiria*, Provinces of *Germany*, and *Bosnia* and *Servia* on the South: the best part of it is under the Dominion of the *Turk*, the rest belongs to the Emperor, who is called King thereof; its chief Cities are *Buda* the Capital, which the *Germans* call *Offen*, *Strigonia*, which they call *Gran*, *Alba Regal*, five Churches, *Canise*, *Javarin* or *Rab*, *Gomorre*, *Presbourg*, and some others. This lovely Country hath been the Theatre of much Christian and Turkish blood, which hath dyed the Rivers of *Marish* and *Rab*, that falls into the *Danube*, which runs through the middle of this Kingdom.

A Table of the Longitudes and Latitudes of the principal places in *Hungary*.

Hungarea, Christiau and Turkish.

	Lat.		Long.	
Presburg	48	2	40	1
Zerdabell	48	0	40	3
Raab	47	5	41	0
Lynback	47	0	39	3
Thara	47	0	41	1
Eskeneck	47	3	41	1
Weisbrun	47	1	40	4
Carpornack	46	5	40	0
Sarwar	47	3	40	1
Tyrna	48	5	40	3
Newsol	48	3	42	0
Fillek	48	0	42	3
Porn	48	3	43	1
Cæsseria	48	4	43	4
Tokay	48	0	43	4
Zarmar	47	4	45	2
Zygeth	48	2	45	4
Ungivar	44	4	48	3
Perigea	48	2	45	5
Eperies	49	0	43	4
Muan	48	4	42	4
Leutch	49	0	43	0

Esclavonia.

	Lat.		Long.	
Warisdin	46	3	39	3
Zaarab	46	0	40	0
Novigrad	46	1	39	2
Fort de Serin	46	3	40	0

Croatia.

Carlestad	45	5	38	5
Serin	45	4	39	3
Kerstin	45	3	39	1

Morloquia.

Zegna	45	1	38	4
Modrusti	45	2	38	5
Ouglin	45	2	38	5
Tersack	45	3	37	5

Hungaria Turkish.

Betwixt *Danube* and *Draw*.

Canisia	46	4	40	0
Alba Reg. or *Stullweisstukirg.*	47	0	41	1

Petche

	Lat.		Long.	
Petche or 5 *Ecclesiæ*	46	1	42	1
Muhacz	46	1	43	0
Buda, Offen, Pest	47	1	42	2
Gran. Strigon	47	4	41	4
Betwixt *Danub* and *Tibisch*				
Zeged	46	3	44	0
Zolnock	47	1	43	5
Hat an	47	2	42	4
Agria	48	0	43	0
Fristat	47	3	42	0
Newhastel	48	1	41	0
Betwixt *Tibish* and *Marish.*				
Waradin	47	0	45	0
Fekyn	46	5	44	0
Solmos	45	2	46	2
Gyula	46	4	44	4

Betwixt *Marish* and *Danub.*

	Lat.		Long.	
Chonad	46	2	44	1
Temeswar	45	5	44	4
Sippa	46	1	45	1
Beckskerke	45	3	44	0
Trena	45	4	46	2
Esclavonia Turkish.				
Potega	45	4	41	1
Zakocz	46	0	40	3
Passaw	46	0	40	2
Arky	45	2	41	4
Croatia.				
Wibitz	45	1	39	5
Sisseg	45	5	39	4
Dubitz	45	4	40	3
Velay	45	1	39	3

CHAP. XI.

Transilvania, *Moldavia*, *Walachia* and *Bessarabia.*

THESE four Provinces which are under the Power of the Turk lye on the North side of the *Danube.*

Transilvania hath to the East *Moldavia* and *Walachia*, to the South and West *Hungary* and *Walachia*, and to the North the Territories of *Poland*; its chief Cities are *Hermenstadt, Cronstadt, Clausembourg*, and *Wasterbely*: its Rivers are *Marish*, *Aluta*, and the *Tibisque.*

Moldavia hath to the East *Bessarabia* and *Bulgaria*, to the South *Walachia*, to the West *Transilvania* and *Walachia*, and to the North *Podolia* and *Volhinia*; its Capital City is *Jasi*: the *Pruth* watereth it, and the *Danube* divides it from *Bulgaria.*

Walachia hath to the East and North *Moldavia*, to the West *Transilvania*, and to the South *Bulgaria*, from which it is divided by the *Danube*: its Capital City is *Tergonisk.*

Bessarabia hath to the East the *Black* Sea, *Podolia* to the North, to the West *Moldavia*, and *Bulgaria* and the Mouths of the *Danube* to the South: *Billagroe* at the Mouth of the *Neister* is one of its chief Towns.

A Table of the Longitudes and Latitudes of the principal places in *Transilvania, Moldavia, Walachia, Bessarabia,* and *Petit-Tartaria.*

Transilvania.

	Lat.		Long.	
Berensayd	46	2	46	4
Wessenburg, or *Alba Julia*	46	5	47	0
Kerezbania	46	5	46	0
Clausenburg, or *Colasswar*	47	1	45	3
Zygeth	41	5	46	2
Medwish	47	2	47	4
Stephunople	47	1	49	1
Vasarl el	47	3	49	2
Czyck	47	4	48	4
Kisdy	47	3	48	0
Newmark	47	3	47	2
Torda	47	2	46	5
Dees	43	3	46	2
Chiche	47	4	46	1
Zatmurbania	48	0	46	0
Rodna	48	0	46	2
Tekendorph	47	4	46	5
Rothmburn	46	4	48	2

Moldavia.

Soczowa	47	3	50	3
Targorcd	46	5	50	3
Jassy	47	3	51	5
Sereth	46	5	50	0
Pudna	45	3	51	1

	Lat.		Long.	
Burlach	46	2	51	4

Walachia.

Orano	45	0	47	0
Zelatna	45	3	47	5
Tarvis	45	5	49	4
Ermistat	45	0	50	1
Braislaw	46	3	49	3

Bessarabia.

Tekyn	47	4	54	1
Bicelegrod	47	3	56	3
Kilia Nova	46	0	55	2
Kiliastry	46	4	55	4

Tartars upon the mouth of the *Nieper.*

Gracow
Kudack
Stirlnicza

Crim Tartars neer the Lake *Mæotis,* or *Petit Tartary.*

Tartaria Precop.

Capha Turk	47	1	64	4
Basicsara	47	5	63	5
Strayt or *Precop*	49	0	63	3
Kerci	47	5	66	5
Azow or *Asack Turkish*	51	2	73	0

CHAP. XII.

Sclavonia, Bosnia, Servia, Bulgaria and *Romania.*

L*Iburnia* and *Dalmatia* are but a part of that which was anciently called *Illirium*, and since *Sclavonia*, from the *Sclavonians* that seated themselves there: it comprehended besides, *Croatia*, *Stiria*, *Carinthia*, *Carniola*, and many other Provinces bordering on the *Danube* and *Adriatick* Sea.

Dalmatia hath to the West *Istria*, to the North *Croatia*, to the East *Albania*, and to the South the Gulf of *Venice*: the most remarkable Towns of it are *Zara*, *Sebenico*, *Spalatro*, which belong to the *Venetians*, and *Raguza* which is taken for the ancient *Epidaurus*, and is a small Republick, Tributary to the Turk.

The Capital City of *Croatia* is *Gradischia*: of *Bosnia*, *Belgrade*.

Servia hath *Semandria*, and *Bulgaria*, *Sophia*: for its Capital these two Provinces are the ancient *Mœsia*.

Romania, heretofore called *Thrace*, hath *Constantinople* for its Metropolis: it was anciently called *Bizantium*, and was the Seat of the *Grecian* Emperors, as it is at present of the *Ottoman*: it is Situated on the *Bosphorus* of *Thrace*, called now the Channel of the *Black* Sea, and is one of the fairest and largest Cities in the World. The stately remains of the Church of St. *Sophia*, built by *Justinian*, and now converted into a Mosque, are to be seen there, with the *Seraglio*, which is the Palace of the Grand Seignior, and one of the fairest in the World. The other Cities of that Country are *Adrianople*, *Philippopoli*, *Philippi*, *Trajanopoli*, *Gallipoli*, and *Sestos* on the *Hellespont*, opposite to *Abidos* in *Asia*, where are two Castles called the *Dardanelli*, which defend the passage to the Sea of *Marmora* and *Constantinople*.

CHAP.

CHAP. XIII.

Greece.

UNDER the name of *Greece* were anciently comprehended, *Macedonia*, *Epirus*, *Thessaly*, *Phocis*, *Bœotia*, *Achaia*, *Peloponesus*, and some other Provinces which have now lost both names and their limits: they are environed by the *Egean* Sea or *Archipelago* on the East, by the *Cretan* or Sea of *Candy* on the South, by the *Ionian* and *Adriatick* Seas on the West, and *Mæsia* on the North.

The chief Towns of *Macedonia*, are *Salonichi*, heretofore *Thessalonica*, *Pella* famous for the birth of *Alexander*, and *Stagira* for that of *Aristotle*. Mount *Athos*, now called *Monte-Santo*, and the River *Strimon* are in this Province.

Croia is the Capital of *Albania*, heretofore called *Epirus*; its other Towns are *Durazzo*, *La Valona* and *Scutari*.

The Cities of *Thessaly* are *Larissa* and *Pharsalia*, whose Fields were dyed with the *Roman* blood in that famous Battel wherein *Cæsar* overcame *Pompey*; there is the River *Peneus*, and the Valley of *Tempe*. the Mounts *Olympus*, *Ossa* and *Pelion*, so Celebrated in the Writings of the ancient Poets.

Phocis had in ancient times the City of *Delphos*, with the Temple of *Apollo*, renowned for its Oracle all the World over; there you may see the Mount *Parnassus*, heretofore Sacred to the Muses, and so Celebrated by the Poets, now inhabited by nothing but ignorance and Barbarism.

Thebes was the Capital of *Bœotia*, where *Bacchus*, *Hercules* and *Pindar* were born.

Attica was the chief Province of *Achaia*, and in it was *Athens*, the Nursery of many great Men; it was the Residence of the Learned and the Heroes: there remain in it now but some pitiful ruinous places, which are called *Setines*, *Megara* *Eleusis*, and some others.

Peloponesus, called at present *Morea*, is almost and Island joyned to *Achaia* by a Neck of Land, which was called the *Isthmus* of *Corinth*, from the adjoyning City of that name: the other Towns were *Mycene*, *Argos*, *Sycione*, *Pisa*, (where the *Olympick* Games were Celebrated, and where that famous Statue of *Jupiter Olympus* stood, which was reckoned one of the seven wonders of the World.) *Sparta* or *Lacedæmon*, all Famous and Learned Cities, but now buried under their own Ruins and Barbarity, as all *Greece* is, which though heretofore the School of the Liberal Arts and Sciences, is now plunged into an abyss of ignorance, and groans under the Tyranny of the Turks. These follow the Religion of their Prophet *Mahomet*, and the Native *Greeks* that of the *Greek* Church.

A Table of the Longitudes and Latitudes of the principal places of *Turky* in *Europe*.

In *Bosnia*.

	Lat.	Long.
Saraio	44 4	42 4
Jaicza	44 4	41 4
Bagnialuc	44 0	42 2
Ternovzza	44 2	43 2

In *Servia*.

	Lat.	Long.
Pristina	43 2	44 1
Novibazur	43 2	46 5
Drin	43 3	45 0
Semandrie	44 2	47 4

In *Bulgaria*.

	Lat.	Long.
Nizza	43 4	47 3
Guistadile	44 0	48 2
Viddin	44 5	47 4
Nigeboli	44 0	51 3
Uzckub	43 0	48 0
Sofie	43 0	50 3
Haresgred	44 0	50 2
Axiopoli	45 0	51 2
Silistra	43 3	50 3

In *Romania*.

	Lat.	Long.
Constantinople, or *Stamboli*	43 0	56 2
Chiorkick	43 0	55 0
Gallipoli	41 4	55 4
Adrianople	43 1	53 0
Eschibaba	44 1	53 2
Trajanople	42 3	53 2
Nicopoli	42 2	51 2
Kirklisi	43 3	50 4
Caridio	41 3	55 0
Mesembria	44 4	54 4
Sosi	41 1	55 2
Varna	45 0	54 4
Tomi	45 4	55 0
Silistria	45 2	52 3
Zelmi	44 4	52 2

	Lat.	Long.
Asperosa	41 4	52 2

In *Macedonia*.

	Lat.	Long.
Philippi	41 4	51 5
Cavula	41 5	50 4
Strimon	42 2	50 2
Heraclia	42 2	40 2
Middle of Mont *Sabo*, or Mont *Athos*	41 0	52 0
Cassandria	50 4	50 1
Salonichi	41 2	49 0
Veria	41 0	48 0
Contessa	41 3	51 2
Acomania	40 4	50 1

In *Thessaly*.

	Lat.	Long.
Larissa	39 3	48 4
Armiro	38 5	49 2
Tricca	39 1	47 5

In *Achia*.

	Lat.	Long.
I. *Negropont*	38 1	51 0
Corone	38 0	50 0
Stives, or old *Thebes*	38 0	50 0
Marathron	37 4	50 5
Sctines, or *Athens*	37 1	50 4
Megara	37 2	49 3
Solona, or *Delph*	37 5	48 2
Lepanto	37 3	47 5

In *Morea*, or *Peloponesis*.

	Lat.	Long.
Patras	37 0	47 4
Coranio		
Pylos	36 3	47 0
Sangaenico	36 1	47 4
Arcadia	35 2	47 3
Coron	35 0	49 1
Modon	34 5	48 2

In *Lacedemon*.

	Lat.	Long.
Argos, or *Misistra*	35 4	49 4

Corint

	Lat.		Long.	
Corinte	36	5	49	3
Napoli	36	2	50	2
Arges	36	2	49	4
In *Epyre.*				
Perga	38	5	45	4
Butrinto	38	5	45	1
Chimera	39	2	44	1
Larta	38	3	47	2
Bastie	38	4	45	4
Cunina	40	1	44	2
Valdelorsa	40	1	44	0
Preueza	38	2	46	4
Albania.				
Valona	40	0	44	5
Elbuscan	41	0	45	4
Pirgo	41	0	44	3
Durazzo	41	0	45	0
Croia	41	1	45	2
Scutari, or *Iscodar*	41	5	45	2
In *Dalmatia.*				
Ragusa	42	4	43	3
Dulcingo	42	0	44	0
Budoa	42	1	43	1
Castel Nova	42	4	43	3
Narenza	43	2	43	1

	Lat.		Long.	
Risin	42	1	44	2
Catero	43	1	44	4
Islands neer *Greece.*				
Isl. *Stalimen*	41	0	52	2
Isl. *Tasse*	41	4	52	0
Isl. *Metelene*	49	3	55	2
Isl. *Scio*	38	5	54	3
Isl. *Sciro*	38	5	51	3
Isl. *Andro*	38	0	51	1
Isl. *Morgo*	36	3	54	0
Isl. *Milo*	35	4	52	0
Isl. *Stampalia*	35	4	55	1
Isl. *Cerigo*	35	1	50	2
Isl. *Zante*	36	3	45	2
Isl. *Cepolania*	37	1	46	1
Isl. St. *Maura*	37	4	46	1
Isl. *Corfu*	38	5	44	5
Crim Tartars near the Lake *Mæotis.*				
Tartaria Perecop.				
Copha	47	1	64	4
Basie Sara	47	5	63	5
Strayt and *Precop*	49	0	63	3
Kerci	47	5	66	5
Azow, or *Asack* Turkish	51	2	73	0

CHAP. XIV.

The States of Denmark *and* Sueden.

WE must now visit the North, and take a view of those Countries which lye under Frozen Climates.

The King of *Denmark* possesses there the *Cymbrian Chersonesus*, now called *Jutland*; *Norway*, and several Islands in the *Baltick* Sea, whereof the chief are *Funzen* and *Zealand.*

South *Jutland* comprehends the Dutchies of *Sleswick*, with its City of the same name, and *Holsace* or *Holstein*, wherein are *Segeberg*, *Hambourg*, and *Lubeck* an Imperial Town, and the *Ditmarse*, in which is *Meldorp.*

North *Jutland* has the Towns of *Scagen* and *Ripen.*

Nor-

Norway is a large Country reaching even to the Polar Circle: it is bordered by *Sueden* on the East, and by the Ocean on all the other sides. It had heretofore Kings of its own; its Capital City is *Drandhain*, but the most famous is *Berghen*, a much frequented Sea Port.

Sconen lies to the South of *Gothia*; its Cities are *Lunden* an Archbishoprick, and *Ellebogen* or *Malmoe*.

The Capital City of the Isle of *Zealand* is *Copenhagen*, which is also the Metropolis of all *Denmark*, and the usual Residence of their Kings, as *Roskild* is the place of their Burial. Betwixt this Island and *Sconen* is the famous Streight of the Sound, which is but a mile over; commanded by the Castle of *Crenemberg* on the side of the Island near *Elsenor*, and on the opposite side in *Sconen*, by that of *Elsenbourg*: here all Vessels are obliged to pay Toll to the King of *Denmark*. Near to this Streight is the Isle of *Ween* or *Huenna*, whither the illustrious *Tycho-Brahe* retired to make his Astronomical Observations.

Odensee is the chief Town of the Isle of *Fuinen*, between which and *Zealand* is the other passage called the *Belt*.

The other Isles are *Laland*, *Feneren*, *Faster*, *Muen*, and many more.

The King of *Denmark* possesses also *Iseland*, and the Isles of *Feroe*, Situate between it and the North of *Scotland*.

The *Lutheran* is the only Religion permitted within the States of the King of *Denmark*.

The King of *Sueden* possesses *Sueden*, *Gothia*, *Finland*, *Bothnia*, *Scricfinnia*, and part of *Lapland*, with the Isles of *Gotland* and *Rugen*.

The chief Towns of *Suedland*, are *Stockholm* the Metropolis of the State and Residence of the Kings, built upon Piles like *Venice*, in the Lake *Miler*: *Upsale* an Archbishoprick and University.

Gothia is to the Southward of *Sueden*, properly so called; its most considerable Towns are *Northcopen* and *Calmar*.

Finland, whose Eastern part is likewise called *Carelia*, lies to the East of *Sueden*, divided from it by the Gulf of *Bothnia*, and hath the *Finnick* Gulf to the South, and *Russia* to the East; its more remarkable Towns are *Wibourg* and *Rasenbourg*.

Bothnia lies North from *Finland*, and its chief Town is *Torne*.

Lapland belongs partly to the *Muscovite*, and hath no Cities, but pitiful Villages: it is the Country of the *Laplanders*, a Barbarous people, some of which are still Idolaters, and obey partly the King of *Sueden*, and partly the great Duke of *Muscovy*.

Suedland embraced long ago the *Lutheran* Religion, which it professes at this day.

In the extremities of the North, are *Finmarchia* or *Scricfinnia*, belonging partly to the Crown of *Suedland*, and partly to that of *Denmark*.

It is to be observed, that *Norway*, *Sueden*, *Sconen*, *Gothia*, *Finland*, *Lapland*, *Bothnia*, *Scricfinnia*, and *Biarmia*, lie in a Peninsula, called *Scandia*, or *Scandinavia*, on the West and North sides encompassed by the Ocean, on the South by the *Baltick*, and on the East by the Gulf *Botnia*.

A Table of the Longitudes and Latitudes of the Principal Places in *Denmark*.

	Lat.	Long.
North *Jutland*.		
Scaw	58 3	32 0
Alburg	57 4	31 3
Wensissel	58 0	31 0
Hobro	57 1	31 1
Wiborg	57 2	30 2
Holstbro	57 1	29 3
Lemwick	57 0	29 4
Randersen	57 1	31 3
Ebeltode	57 0	32 1
Arhusen	57 0	31 4
Ring Koping	57 0	29 1
Weel	56 3	31 1
Ward	56 4	30 1
Henneborch	56 2	31 2
Kolding	56 1	31 0
Rypen	56 0	30 2
Hadersleve	55 5	31 1
South *Jutland*.		
Tonderen	55 4	30 5
Appenrade	55 4	31 2
Flensburg	55 2	31 3
Heswick	55 1	31 3
Gottorp	55 1	31 2
Husum	55 2	30 4
Froderickstad	55 0	31 0
Tonningen	55 1	30 3
Holstein.		
Rensburgh	54 5	31 3
Kiel	54 5	32 1
Lander	54 4	30 5
Meldorp	54 5	30 3
Wilster	54 3	30 4
Newminster	54 3	31 4
Ploen	54 3	32 2
Newstad	54 4	32 5
Oldenburg	54 5	32 5
Oldeslhe	54 2	32 1.

	Lat.	Long.
Lubeck	54 2	32 4
Holsece.		
Gluckstad	54 2	30 3
Brams	54 1	31 4
Wedel	54 1	31 0
Hambrough	54 0	31 3
D. *Lawenburg*.		
Lawenburg	53 5	32 4
Ratzburg	54 0	32 4
Isl. of *Funen*.		
Odensoe	56 1	31 4
Niburg	56 0	32 2
Foburg	55 5	32 0
Midlefaro	56 1	31 2
Isl. of *Seeland*.		
Copenhagen	56 2	34 4
Nestwed	55 5	33 1
Roskild	56 3	34 0
Kallenburg	56 3	33 0
Kronemburg	56 3	34 4
Laland.		
Naskow	55 3	33 1
***Falster* Isl.**		
Nicoping	55 3	33 4
Isl. *Bernholm*.		
Rundneby	55 4	37 1
S. *Gotland*, viz. *Halland*.		
Waersberg	57 3	34 1
Helmsted	57 1	34 5
Laholm.	57 0	35 0
Schonen.		
Cape *Kola*	56 5	34 3

	Lat.	Long.
Helsmgburg	56 4	34 5
Landscroon	56 3	35 0
Lunden	56 2	35 3
Mulmuyten	56 1	35 1
Udstad	55 5	35 5

Elebrug.

	Lat.	Long.
Christianstad	56 3	36 1
A Huys	56 2	36 1
Ellebolm	56 3	37 0
Christianople	56 4	38 2

A Table of the Longitudes and Latitudes of the principal places in *Scandinovia*, *Norway* and *Suedeland.*

Government of *Aggerhus.*

	Lat.	Long.
Fredericstat	59 3	32 3
Berga	60 2	32 3
Obslo	60 3	31 0
Lindsness	59 0	27 3

Government of *Babus.*

Babus	58 1	34 0
Dalcburg	58 4	34 0

Government of *Bergenbus.*

Eye	59 0	26 3
Stavanger	59 5	26 2
Bergen	61 0	26 4

Government of *Dronthenbus.*

Boe	64 0	28 0
Dronthem	65 3	32 3
Maelstroom	68 3	32 3

Government of *Wardhus.*

North Cape	71 2	48 1
Wardhus	70 5	54 2

Suedeland.

West *Gothland.*

Gotteburg	57 3	33 3
Lidkoping	58 3	35 1
Scofde	58 3	35 4

East *Gothland.*

Linkoping	58 3	38 3
Norkoping	58 3	38 4

	Lat.	Long.
Soderkoping	58 4	38 3

Isl. *Oeland.*

Borckholme	57 0	39 0

Isl. *Gothland.*

Wisby	57 4	41 3

Westermalne, *Soudermain*, and *Firmeland.*

Nikoping	58 4	39 4
Koping	59 4	39 0
Phillipstad	59 5	36 2
Carolstad	59 3	35 4
Kolen	60 2	34 0

Upland.

Stockholm	59 2	40 4
Upsul	60 0	40 2
Enkoping.	59 4	40 0

Gestricie.

Gevalia	61 0	40 0

Helsinge.

Dilsbo	62 0	39 1

Madelpædie.

Tana	62 0	38 0
Trop	62 1	39 0

Agermain.

Bote	63 0	40 0
Nord Mating	63 0	42 0

Lapland

Lapland, or West *Bothinia.*

	Lat.	Long.
Uma Lapmark	63 3	42 0
Pitha Lapmark	65 3	43 5
Lula Lapmark	65 3	44 2
Torne Lapmark	65 4	46 0

East *Bothinia.*

Vlaburgh	65 3	47 0
Cajaneburg	65 1	51 4
Salo	64 4	47 0
Carleby	64 0	45 3
Kyro	63 3	45 0

Finland.

Abo	60 4	45 4
Bierneburg	62 0	45 0
Gronenburg	61 3	48 3

Niland.

Rafeburg	61 1	47 0

Savolax.

	Lat.	Long.
Indisalmi	63 3	50 2
Nislot	51 4	53 3
Cæreba		
Vakelax	60 4	51 2
Wiburg	60 3	53 2

Kexbolm.

Kidilia	61 3	56 0
Kexholm	61 3	55 0

Ingria.

Notteburgh	59 5	55 4
Jamagored	59 0	52 3

Livonia.

Narva	59 0	52 3
Revel	59 3	48 3
Pernaw	58 5	47 3
Derpt	58 3	51 0
Riga	57 1	47 4
Kockenhaus	57 0	49 2
Dunenburgh	56 4	50 2

CHAP. XV.

Great Russia, *or* Moscovy.

THAT Prince whom we call the Great Duke of *Moscovy*, is by his Subjects called *Czar*, which is as much as to say, Emperor; and he may very well take that lofty Title, seeing his State is one of the greatest in *Europe*, and reaches even to *Asia*, and he is so absolute a master of the Lives and Fortunes of his people, and his Empire Despotick; on the East it is bordered by *Tartary* the Great, on the South by the Lesser, on the West by the States of *Poland* and *Suedland*, and by the Ocean on the North: it comprehends Great *Russia*, which is divided into many Provinces.

Mosco is the Capital City of the State, and gives its name to the whole Empire, which it receives from a River that washes it; it is built of Wood, and contains above forty thousand Houses: The other remarkable Cities are *Sandomiry*, *Molodimer*, *Novogord*, and many more. Upon the White Sea, which is a Bay or Gulf of the Northern Ocean, are St. *Michael* Arch-Angel, and St. *Nicholas* at the mouth of the *Divina*, which is one of the greatest Rivers

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vers in *Russia*: the other Rivers are the *Boristhenes*, at present the *Nieper*, that falls into the *Black* Sea, the *Tanais*, now called *Don*, which discharges it self into the *Palus Maotis*, or *Delle-Zabache*. The *Volga*, heretofore *Rha*, which having its spring head in that Country, after a long Course, carries its Streams into the *Caspian* Sea.

The *Moscovites* follow the Religion of the *Greek* Church.

A Table of the Longitudes and Latitudes of the principal places in *Russia*, or *Moscovia*.

	Lat.		Long.	
Lapland Moscovites.				
Kielit	68	3	58	0
Joskena	68	1	66	1
Cape *Cadenus*	68	0	72	0
Kenio	65	0	55	5
Dukedoms of				
Karagopel	62	0	67	0
Dwina				
St. *Michael Arch-Angel*	64	5	67	1
St. *Nicholas*	65	0	66	3
Lampat	66	0	71	0
Inborn	68	2	73	4
Condinsky				
Koma	62	3	77	2
Petzora	68	2	87	1
Samoides.				
Strait of *Wagote*	70	0	87	3
Kingdom of *Roym de Siberia.*				
Tobolska	97	3	65	0
Perma	62	0	84	½
Oustiough upon *Dwina*	61	2	73	1
Wologdia	58	4	67	2
Bielaozero	58	0	63	0
Upon *Volga R.*				
Gero	57	3	66	1
Nisi Novogord	56	0	75	0
Wasilsgorod	55	3	77	1
Casan K.	55	3	84	4
Bolgar	54	2	84	5

	Lat.		Long.	
Astracan R.	46	2	87	3
D. *Wolodinie*	55	4	70	2
D. *Susdale*	56	0	65	3
D. *Rosthow*	57	2	65	1
D. *Moskow*	55	4	64	4
D. *Resan*	55	0	69	0
D. *Worotin*	54	2	63	1
D. *Smolensky*	54	3	57	2
D. *Reskhow*	56	0	61	2
D. *Tiver*	56	4	62	0
D. *Novogrod Wiliki*	58	0	57	1
Kielit	66	3	57	0
Kandalax	68	0	59	0
Kola	70	0	57	0
Cape *Caudenos*	69	2	70	0
Kargapol	62	1	66	0
St. *Michael Arch-Angel*	64	4	67	0
St. *Nicolas*	64	4	66	0
Inbera	68	0	76	0
Streight of *Waigates*	71	0	85	0
Toboska	65	½	95	0
Perma	63	2	83	0
Oustiough	61	0	72	0
Wologda	59	3	67	0
Bialaozero	59	0	62	0
Jeroslau	57	3	65	0
Lesser *Novogrod*	59	0	71	3
Vasili gorod	59	0	73	0
Cazan	58	2	84	0
Bulgar	56	3	36	0
Astracan	49	2	83	3
Wlodimer	58	0	69	0
Susdal	57	1	63	0
Rostow	56	4	64	0
Moskow	55	0	64	3

Rezan

	Lat.	Long.		Lat.	Long.
Rezan	54 4	67 0	*Rzowa*	56 0	59 0
Worotin	53 2	64 0	*Twer*	55 4	62 0
Smolensko	54 0	57 0	Greater *Novogrod*	58 3	57 0

CHAP. XVI.

The Lesser Tartary.

THE States of the Prince of *Przecop*, or of the lesser *Tartars*, lie betwixt the mouths of the *Boristhenes* and *Tanais*; and in that Peninsule which the Ancients called the *Taurick Chersonesus*, bounded on the East by the *Palus Meotis*, and on the South and West by the *Black* Seas; on the *Isthmus* thereof stands the City of *Przecop*, which hath given the name of *Przecopites* to that People, and the City of *Caffa* is its Capital: the Streight that joyns the *Palus Meotis* to the *Euxin* Sea, was heretofore called the *Cimmerian Bosphorus*, and is now termed the Streight of *Caffa* or *Vospero*, and St. *Johns* Mouth.

The *Tartars Przecopites* are by Religion Mahometans.

CHAP. XVII.

The States of the King of Poland.

THESE States have the Territories of *Moscovy* on the East, on the North those of *Sueden* and the *Baltick* Sea, on the West *Germany*, and on the South the *Carpathian* Mountain which divides them from *Hungary* and *Transilvania*: they comprehend *Poland*, *Prussia*, *Lithuania*, part of *Livonia*, *Massovia*, *Podlassia*, *Podolia*, *Volhinia* and *Russia-Nigra*.

The Capital City of *Poland* is *Cracovia*, which is the Metropolis of the State; the others are *Guesn* an Archbishoprick, *Sandomeria*, and many more less considerable.

Prussia Regalis belongs to the King of *Poland*, and its chief Towns are *Moriembourg* and *Dantzick*, which has a famous Port on the *Baltick* at the Mouth of the *Weisel* or *Vistula*.

Prussia the *Ducall* belongs to the Marquess of *Brandebourg*, who does homage for it to the King of *Poland*: its Capital City is *Koningsberg*, or *Regiomontum*.

The

The Capital of *Lithuania* is *Vilna.*

In *Livonia*, or *Liefland*, are the Towns of *Riga*, *Reuel* and *Torpach*; it belongs almost wholly to the *Suede*, being yielded to that Crown by the Treaty of *Oliva* in the Year 1660.

The Capital of *Massovia* is *Warsaw*, of *Podlassia*, *Bijelsko*: *Caminick* and *Bar* are in *Podolia*, and *Vlodimer* in *Volhinia*

Leopolis an Archbishoprick is the Metropolis of *Russia-Nigra*.

Samogithia is also a Province of that State, but hath neither Town nor Castle.

The Rivers of that Country are the *Vistula* or *Weisel*, that passes by *Cracovia*, *Sandomeria* and *Dantzick*.

The *D'una* passing by *Riga* into *Lithuania*.

The *Boristhenes* or *Nieper* bounds these States on the East, having its mouth in the *Ukraine*, the Country of the *Cosacques*, who are under the Dominion of the King of *Poland*, but none of the best Subjects.

The *Catholick* Religion is the strongest in these States, but the *Calvinist* and *Lutheran* are professed there also.

A Table of the Longitudes and Latitudes of the principal places in *Poland* and *Lytuania*.

Prussia Royal to *Poland.*

	Lat.	Long.
Dantzick	54 2	41 5
Elbing	54 1	42 4
Marienburg	53 5	42 1
Newenburg	53 3	41 5
Culm	53 1	41 4
Thorn	53 0	41 4

Prussia Ducal to *Brandenburg.*

	Lat.	Long.
Brandenburg	54 3	43 4
Koningsburg	54 3	44 0
Alterburg	54 2	44 4
Tilse	54 5	45 4
Memmel	55 4	45 0

Samagotia in North *Russia.*

	Lat.	Long.
Midnick ab Nomie	55 3	46 1
Rosienne	55 2	46 5
Heligaw	56 0	44 4
Birce	56 0	48 5
Tauragen	55 1	46 1

Curland in North *Russia.*

	Lat.	Long.
Mittaw	56 3	47 3
Goldingen	56 4	45 4
Windaw	57 0	45 0
Liba	56 2	44 4
Plenen	57 1	46 2

Lithuania.

Palatinate de *Poloczk.*

	Lat.	Long.
Poloczk	55 2	53 3
Rosian	55 0	55 2
Drissa	55 5	52 1

Pal. de *Witepsk.*

	Lat.	Long.
Scasnistere	55 0	54 2
Witepsk	55 2	55 4
Witlisst	55 4	57 0
Vla	55 0	54 3
Horodeck	55 4	55 3

Pal. of *Vilna.*

	Lat.	Long.
Breslaw	55 4	50 4
Vilna	54 3	29 1
Froki	54 3	48 4
Milkemirs	55 0	48 4

Opixty

	Lat.	Long.
Opixty	55 1	49 0

Pal. of *Troki.*

	Lat.	Long.
Troki	54 3	48 4
Pubinki	54 5	49 2
Kowne	54 4	47 4
Grodne	53 4	47 3
Lida	53 5	49 0
Wilkewiska	53 1	48 3
Bielica	53 4	49 1
Asuriana	54 2	49 4

Pal. d' *Minsk.*

	Lat.	Long.
Minsk	53 5	51 4
Borislaw	54 0	53 2

Pal. of *Novigrodeck.*

	Lat.	Long.
Novigrodeck	53 3	49 3
Skenim	53 0	49 0
Hasko	53 0	51 4
Mir	53 2	50 2

Pal. de *Mesillaw.*

	Lat.	Long.
Mesillaw	54 0	58 0
Orssa	54 2	56 0
Mobilow	53 4	56 0
	54 3	47 3
Robakzo	52 5	55 0
Rzeczyoa	52 0	56 0

Pal. of *Bressici.*

	Lat.	Long.
Bressici		
Pinek		
Horodeck		
Kolne		

Nassovia.

	Lat.	Long.
Warsaw	52 1	44 1
Pultansk	52 4	44 3
Czersko	51 5	44 3
Wiskow	52 2	44 2
Nar	52 3	46 1
Wishegred	52 3	43 0

Poland.

Pal. of *Plotsko.*

	Lat.	Long.
Plotsko	52 3	42 4
Plousko	52 5	43 0
Doberin	52 3	42 2
Reppina	52 5	42 3

Pal. of *Inowlocz.*

	Lat.	Long.
Inowlocz	52 5	41 2
Wladislaw	52 4	40 4
Fredrelant	53 2	40 4

Pal. of *Posua.*

	Lat.	Long.
Posuan	52 2	40 3
Rogosua	52 4	39 5
Welin	52 5	38 5
Krziwin	52 0	40 3
Miedzersec	52 2	38 2

Pal. of *Kebish.*

	Lat.	Long.
Ghesna	52 3	40 5
Kælish	51 5	40 5
Navle	52 5	40 1
Lawdic	52 1	41 1
Colo	52 1	41 3

Pal. of *Brest.*

	Lat.	Long.
Brestie	52 3	42 0
Kraswick	52 4	41 1

Pal. of *Rava.*

	Lat.	Long.
Rava	51 5	42 3
Gabni	52 2	52 3
Gostinin	52 2	52 4

Pal. of *Seradia.*

	Lat.	Long.
Serad	51 3	41 0
Telun	51 1	40 5
Krzepick	51 0	41 0

Pal. of *Lencici.*

	Lat.	Long.
Lencici	52 1	41 4
Bresini	52 3	42 5

Pal.

Pal. of *Saudomira.*

	Lat.		Long.	
Lawichest	51	3	45	0
Saudomire	50	3	44	4
Visliczca	50	1	43	3
Malogocz	50	4	42	5
Zarnaw	51	1	42	5
Radom	51	1	44	0

Pal. of *Cracaw.*

Cracow.	50	0	42	3
Zacor	49	5	42	0
Nowopol	50	5	41	5
Sandecz	49	4	43	1
Frecz.	49	4	43	4

Pal. of *Lublin.*

Lublin	51	0	45	1
Czetiche	51	3	44	4
Kazimeeres	51	0	44	4
Lukow	51	4	45	4

Pal. of *Bielsk.*

Bielsk	52	4	47	1
Grodeck	62	1	56	2
Auston	53	4	46	4
Goniutz	53	2	46	1
Drogierin	52	1	46	2
Pal. de *Chelia*	51	0	46	3
Dubur	50	5	77	1
Kranoslow	50	5	46	0
Pal. of *Belcz*	50	1	47	4
Krilow	50	3	17	2

	Lat.		Long.	
Pal. de *Lemburg Terpold*, or *Low*	49	4	46	5
Halicz	48	5	47	5
Premislaw	49	3	45	3
Sanock	49	1	45	1
Sniatin	48	3	48	4

Pal. of *Lusuck*, or *Vithinna.*

Mlodzimeers	50	4	47	4
Constantino	51	1	49	5
Horeskle	50	5	52	5
Lusuck	50	4	49	0
Pal. of *Kaminieck*	49	5	48	4
Barr	49	1	51	2
Bourack	49	0	48	3
Pal. de *Bracklaw*	52	4	48	5
Minicza	49	2	52	2

Ukrain, or *Cossacks* Country.

Base Podolia.

Bialcerkew	50	0	54	4
Grudeck	50	0	53	2
Kiovia	50	4	55	2
Czyctkassia	49	3	56	3
Kudack	48	5	59	3
Krilow	49	2	47	3
Isles of y *Tar-Treasure*	48	0	58	1

Dutche de *Czennihow.*

Moryn	51	2	56	4
Kozel	50	2	57	4
Czernihow	51	5	57	0

CHAP. XVIII.

The Isles of Europe.

THE Isles in the Ocean which belong to *Europe*, are in the first place those that are called *British* Isles: under which name are comprehended the Island of *Great Britain*, *Ireland*, the *Orcades*, *Hebrides*, *Anglesey*, *Man*, and Isle of *Wight*; and on the West of *Normandy* are those of *Garnsey* and *Jernsey*, all

all which are under the Dominion of the King of *Great Britain*, and compose one of the greatest States in *Europe*.

The Island of *Great Britain*, which comprehends the Kingdoms of *England* and *Scotland*, is one of the biggest Islands in the Ocean.

The Kingdom of *England* is divided from *Scotland* that lies to the North, by the River of *Tweed*, and *Cheviot* Hills, and from *France* by a narrow Sea called the Channel; the chief Cities thereof are *London* on the *Thames* the Metropolis, *York* and *Canterbury* its two Archbishopricks; *Oxford* and *Cambridg* two famous Universities, and several other great and populous Cities. The chief Rivers of *England* are the *Thames*, the *Humber*, and the *Severne*.

This Kingdom is divided into fifty two Counties or Shires, reckoning the Dominion of *Wales* which lies to the West thereof, from which the eldest Sons of the Kings of *England* have their Titles of Princes of *Wales*.

Scotland a Kingdom to the North of *England* hath *Edinburgh* for its Metropolis, St. *Andrews* and *Glasgow* two Archbishopricks and Universities, and *Aberdeen* another University, with many other Towns of less note: the Rivers of *Scotland* are not very considerable except for Fishing.

The *Orcades* to the Northward of *Scotland*, are many in number, but only thirteen of them are inhabited, and yet more Northerly are the Isles of *Shetland*, belonging likewise to *Scotland*.

The *Hebrides*, or *Hebudes*, are to the West of *Scotland*, and are above three hundred in number, the greatest of which are *Arran*, *Skie* and *Mule*.

The Isles of *Anglesey* and *Man* are to the West of *England*, and the Isle of *Wight* to the South.

Ireland, heretofore *Hibernia*, lies to the West of *England*: it is a great Island, and hath many good Towns, *Dublin* is its Metropolis, and its University, *Armach*, an Archbishoprick, *Cork*, *Limmerick* and *Waterford*: its greatest River is *Shanon*.

Iseland lies under the Polar Circle, which cuts it through the middle, so that part of it lies on the *Frigid Zone*; there is a Mountain here that cast formerly out flames of fire, though at present it ceases, called *Aecla*: they have some, though but few, places of Habitation, the chief of which is *Skalhot*.

The Western Islands called the *Azores* or *Tercera's*, are betwixt *America* and *Europe*, but nearer *Europe*, and therefore they ought to be ranked among the *European* Islands: there are nine of them, *Tercera*, St. *Michael*, St. *Mary*, St. *George*, *Gratiosa*, *Pico*, *Fayal*, *Coruo* and *Flores*.

Tercera that gives the name to all the rest is the greatest, and has a Town called *Augra*; they belong to the King of *Portugal*, and produce plenty of Cedar.

We have spoken of those that are on the Coast of *France*, when we gave the Description of that Country.

There are many Isles in the *Mediterranean* Sea; and we have taken notice already of those that are on the Coasts of *Spain*, *Italy* and *France*: We must now speak of *Candia*, and of the Isles upon the Coasts of *Greece*.

Candy, heretofore named *Creet*, which contained a hundred Towns, has not at present above four or five which deserve that name; *Candia* is the Capital,

tal, and hath given that name to the Island, the others are *Canea*, *Retimo* and *Sitia*: it belonged to the *Venetians*, but after above twenty years War, and that famous Siege of *Candia*, it is at last fallen into the hands of the Turk: it was once the Kingdom of *Minos*, and the Labyrinth that *Dedalus* made was here, and several other things which have been the Theams to the ancient Poets.

Corfou, *Zant*, and *Cephalonia*, are in the *Ionick* Sea under the Dominion of the *Venetians*, as also *Cerigo*, heretofore *Cythera*, which is to the South of *Peloponesus* or *Morea*.

Nigropont, heretofore *Eubœa*, is upon the Coast of *Achaia*; and on the Coast of *Romania* is *Samandrachi*, which was called *Samothracia*, and to the South of this *Italimene*, anciently *Lemnos*, where they dig *Terra Lemnia*, or *Sigillata*.

In fine, the *Egean* Sea, called the *Archipelago*, and *White* Sea, is full of scattered Islands which the ancients divided into the *Cyclades* and *Sporades*, because those lie in a round, and these are dispers'd upon and down,

The most famous have been *Delos* where *Apollo* and *Diana* were born; at present it is called *Sdrille Paros*, now *Paro*, renowned for its White Marble: *Zea Andro*, *Niscia Sifano*, and many others, besides those that are near *Asia*, which we shall afterwards discourse of.

We have already mentioned the Islands in the *Baltick*, which the King of *Denmark* possesses, but there are some others also that belong to the King of *Sueden*.

That of *Oeland* lies opposite to *Calmar*, a Town of *Gothia*; a little more to the North-Eastward is that of *Gotland*, which heretofore had a famous Sea Port called *Wisbuy*, which gave Laws to Commerce and Navigation. The stately Ruins whereof show it to have been very Magnificent.

The Isles of *Offel* and *Dagho* are on the Coast of *Livonia*, and that of *Rugen* is near to *Pomerania*, all which are nnder the Dominion of *Sueden*, but the Isle of *Bornholm* is Subject to the *Dane*.

Before we leave *Europe*, it is to be observed, that it is almost wholly under the *Northern* temperate *Zone*; it hath some Regions indeed under the frozen *Zone*, which are part of *Norway*, *Finmarchia*, and the greatest part of *Lapland*, and some Lands of *Moscovy*, towards the Streights of *Waigatz*, the Streights of *Gibralter*, and Cape *Malapan* in *Morea*, lie in the six and thirtieth Degree of Latitude, and these are the most Southern parts of *Europe*: the North Cape lies in seventy two almost, and is the most Northern place thereof.

The End of the First Book.

A NEW GEOGRAPHY.

The SECOND BOOK.

CHAP. I.

ASIA.

IN the First Book we have given a Description of *GEOGRAPHY* in general, and of all *EUROPE* in particular: In the following Books we shall treat of the other parts of the Earth; and in the first place of *ASIA*, as being contiguous to *EUROPE*.

ASIA, whereof we described the Bounds in the beginning, was variously divided by the Ancients; but at present, these famous Names are abolished, and it looks with a new countenance: I think it ought to be divided according to the Principal Empires that share it, which are under the Obedience of Five Great Monarchs; to wit, the *Grand Signior*, the *King of Persia*, the *Great Mogol*, the *King of China*, and the *Great Cham of Tartary*. To these must be added some Kings of the *East Indies*, with what the *Portuguese* possess there, and the Isles, that are numerous and very considerable.

CHAP. II.

The Empire of the TURK *in* ASIA.

THE Emperour of the Turks, whom we call the *Grand Signior*, has his Imperial Seat at *Constantinople*, which is in *Europe*; but the greatest part of his Dominions is in *Asia*: to wit, *Anatolia*, *Syria*, *Armenia*, *Mesopotamia*, *Arabia*, *Chaldea*, *Mingrelia*, *Georgia*, and *Circassia*.

Anatolia of the Moderns, is the *Lesser Asia* of the Ancients; it is on three sides encompassed by Seas, on the North by the *Black Sea*, on the West by the *Propontis* and *Archipelago*, on the South by the *Mediterranean*; and hath the River *Euphrates* on the East. It was heretofore divided into Two and twenty Provinces, *Pontus*, *Bithinia*, *Asia* Propper, the greater and lesser *Phrygia*, *Troas*, the greater and lesser *Mysia*, *Eolia*, *Ionia*, *Caria*, *Doris*, *Lydia*, *Lycia*, *Paphlagonia*, *Pisidia*, *Isauria*, *Pamphilia*, *Cilicia*, *Lycaonia*, *Galatia* and *Cappadocia*; but at present their Names are lost, their Bounds confounded, their Towns ruined, and their Inhabitants heretofore so polite, are become barbarous. Nor do we certainly know how the Turks divide and name them at present; so that we must rest satisfied to remark the Chief Towns that remain. *Bursa* is one of the most considerable, and was the First Seat of the Turkish Empire; it is a large and well-peopled City: the miserable Remains of *Nice* and *Chalcedon*, famous by their General Councils, and the Ruins of *Troy* are to be seen there. On the *Archipelago* are also *Smyrna*, *Ephesus* where the Temple of *Diana* was, reckoned one of the Seven Wonders of the World, and where a General Council was also held: *Miletum*, *Halicarnassus* which is in *Caria*, where *Arthemisia* erected to her Husband *Mausolus* that Stately Monument which was also ranked among the Wonders: and hence it is that Rich Tombs are called *Mausolea*. On the *Mediterranean* is *Satalie*, which hath given its Name to a Neighbouring Bay; and *Tarsus*, where St. *Paul* was born. On the *Black Sea* are *Trabizonde*, the Seat of an Empire; and in the Countrey of the Amazons *Sinobi*, heretofore *Sinope*, *Angoure* and *Coni*.

Syria hath the Towns of *Aleppo* and *Damascus*, which are two of the greatest Cities of the Turkish Empire. *Said*, anciently *Tyre*, and *Baruth*, heretofore *Sydon*, famous Towns; *Antioch* now ruined, *Alexandretta* or *Scanderoon*, its principal Sea Port; and *Tripoly* of *Syria*.

Palestine, which was comprehended in *Syria*, was called *Canaan* and the *Land of Promise*, *Judea* from a part of it; and the *Holy Land*, because of the Mysteries that there were accomplished. It is bounded on the East by Mount *Libanus* and *Arabia Petræa*, on the South by the same and *Egypt*; on the West by the Sea and *Phœnicia*: it hath been divided into four parts, *Galilee* on the North side, *Samaria*, *Judæa*, and *Idumea*. In *Galilee* is *Nazareth*, where our Saviour was conceived, *Cana* where he changed the Water into Wine;

Wine; *Capernaum* where he often sojourned, and raised the Daughter of *Jairus*; Mount *Tabor*, where he was transfigured; the Sea of *Galilee*, where he calmed the Tempest, and chose some of his Disciples; *Naim* where he raised the Widows Son: all these Towns are now reduced to pitiful Villages. In *Samaria* is the City of the same Name, which was the Seat of the Kings of *Israel*; there remains no more of that City nor of *Sichem*, but deplorable Ruins. In that Countrey also they do shew the Well, at which our Saviour spake to the Samaritan Woman: In *Judæa* is *Jerusalem*, where he suffered death; its extreamly fallen from the ancient splendor it had; nevertheless it is environed with good Walls, and may reach Twelve or Thirteen hundred yards in length, and as much in breadth. It is inhabited by Turks, Moors, and Arabians, who are Mahumetans; by Greeks, Armenians, Syrians, and Cophties. There are no Roman Catholicks there but two Convents of Franciscans, the one of St. *Saviour*, and the other of St. *Sepulcher*; some Jews also live there. That so famous and holy City hath been often ruined, and as often repaired again. Mount *Calvary* and the *Holy Sepulcher* were once without, but now within the City. It would require a Volume to describe all the holy Places that are within and about it.

Two Leagues from *Jerusalem* is *Bethlehem*, where our Saviour was born; it is at present but a Village full of Ruins, inhabited by some poor Christians and Arabians. *Bethany* where he raised *Lazarus*, is nearer to *Jerusalem*, and is but a heap of Ruins; amongst which they still shew the Tomb where the Body of *Lazarus* lay when he was raised from the Dead, and the ruins of his house, of the houses of his Sisters, *Martha* and *Mary*, and of *Simon* the Leper. *Emaus*, where the Disciples knew their Divine Master, tis in no better condition; no more than *Jericho*: upon the Plains whereof rises a Mountain, where our Saviour fasted Forty days. On the Sea-side is *Joppa*, now called *Jaffa*, *Acre* heretofore *Ptolemais*, and in *Idumea* is *Gaza* and some other Towns. *Jordan* waters that *Holy Land*, runs through the Sea of *Galilee*, which is indeed but a Lake; and loses its clear Streams in the stinking and black Waters of the *Dead Sea*: in this River our Saviour was baptized by St. *John Baptist*.

Arabia is divided into three, *Deserta*, *Petrea*, and *Fælix*, or the Desert, *Petrea* or the stony, and the happy, the first two are to the North, and the other to the South.

Arabia the *Desert* is the Countrey where the Children of *Israel* sojourned Forty years, its Chief Places are *Meschet*, *Orem*, and *Ana*.

Arabia Petrea hath *Petrea* (so called from the Name of the Countrey, but now 'tis called *Crach*) and *Eltor*. In this Countrey is Mount *Sina*, upon which God delivered the Law to *Moses*.

Arabia Fælix, or the *Happy*, so called because it is more fertile than the other two, and bigger also; lies between the *Red Sea* which it hath to the West, the Gulf of *Persia* to the East, and the Indian Ocean to the South. Its chief Towns are *Medina*, where the Sepulcher of *Mahomet* the Prophet of the Turks is: *Meccha* the place of his Birth, *Aden* a place of great Traffick,

Sana, *Mocha*, *Soar*, and many others. In this Countrey they gather Frankincence, and ſeveral other precious Gums.

Chaldea is at the Confluence of *Tygris* and *Euphrates*, its Capital was *Babylon* a famous City, and the Seat of the Babylonian Empire, the Walls whereof, built by the Famed Queen *Semiramis*, were placed amongſt the Seven Wonders of the World. It ſtood upon *Euphrates*, and little or nothing remains of it at preſent, and leſs of the Tower of *Babylon*, that was near to it. *Bagdat* is at preſent what *Babylon* was anciently, being built of its ruins; but upon the *Tygris*, as the other was upon *Euphrates*.

The other Towns of *Chaldea* are *Elmara*, *Gorna*, *Balſara*, at the bottom of the Gulf of *Perſia*, *Orchea* which is thought to be the *Ur* of the Chaldees, from whence God called *Abraham*; *Magdon* and ſome others.

Meſopotamia, now called *Diarbeck*, lies to the North of *Chaldea*, and to the South of *Armenia*, between *Euphrates* and *Tygris*; its Chief Towns are *Dava*, *Merdin*, *Orpha*, *Bir*, and *Caramit*.

Armenia is divided into the greater and leſſer, the one on this ſide of *Euphrates*, and the other beyond it; both the two are at preſent called *Turcomania*. The Chief Towns of the leſſer are *Sivas* or *Sebaſte*, *Kemach*, *Erzinga*, and *Suar*. Some place here *Samoſata*, *Lucian*'s Countrey; but it is in *Arminacha*, which was called *Comagene*. Thoſe of the greater, are *Arzeron*, *Chars*, *Eſſechire*, which is taken for the Ancient *Artaxata*. In this *Armenia* is Mount *Ararat*, where the Ark of *Noah* reſted after the Flood. Some affirm that ſome remains of it are ſtill to be ſeen there.

Georgia is to the North of *Armenia*; its Towns are *Cori*, *Scander*, and *Gliſca*; that Countrey is the *Iberia* of the Ancients.

Zuria or *Albania* lies to the Eaſt of it, and reaches to the *Caſpian Sea*. The moſt remarkable places of it are *Derbent*, *Zitracha*, *Sobai* and *Chipiche*.

Mingrelia is now-a-days the *Colchis* of old, whither *Jaſon* went for the *Golden Fleece*; it hath the Sea to the Weſt, and *Georgia* to the Eaſt. *Fazzo* and *Sevaſtopoli* are the more conſiderable Towns thereof.

Circaſſia and *Comania*, Countreys of very little note, lie Northward from he afore-mentioned Territories.

The Iſles that the Turk poſſeſs about *Aſia*, are famous in Antiquity.

Tenedos, at the back of which the Grecian Fleet skulked: *Metelin*, heretofore *Lesbos*, where the renowned *Sappho* was born.

Chio or *Scio*, hath a Town of the ſame Name; this Iſland produces Maſtick and the beſt Turpentine.

Nicaria, anciently *Icaria*, to which *Icarus* by his fall gave the Name.

Samos, where *Pythagoras* was born.

Pathmos, at preſent *Palmoſa*, where St. *John* the Evangeliſt was baniſhed in the time of *Domitian*, and had thoſe Divine Revelations whereof he compoſed the *Apocalypſe*.

Lango, heretofore *Co* or *Cos*, illuſtrious by the Birth of *Hippocrates* and *Apelles*; the one gave men life by his Medicines, and the other by the Touches of his Pencil.

Rhodes

Rhodes retains its Name, but not it its Ancient Splendour : Its called *Rodo*, and hath a Town of the ſame Name. In this place was anciently one of the Seven Wonders of the World, I mean, that Famous *Coloſſus* of Braſs, that was Erected at the Entry of the Harbour, betwixt the legs of which Veſſels paſſed. It was thrown down by an Earthquake. This Iſland is Fifty Leagues in Circuit, and but Six diſtant from *Caria*. The Turks took it from the Knights of *Rhodes*, who afterwards retreated to *Malta*. it hath ſome other places as *Lindo* and *Filerno*.

Cyprus at preſent *Cipro*, is one of the greateſt Iſlands of the *Meditarranean*, being above Six ſcore Leagues in Circumference. It was in Ancient times Conſecrated to *Venus*, and lies in the Sea of *Pamphilia*, which Country it hath to the North, *Syria* to the Eaſt, and *Egypt* to the South: It hath been a conſiderable Kingdom; which from the Houſe of *Luſignan* fell into the Dominion of the Republick of *Venice*; and is at preſent Subject to the Turk. The Chief Towns of it are *Nicoſia* and *Famogoſta*, that hath a good Port.

And thus you have a ſhort Deſcription of the Territories that the Grand Signior, Emperour of the Turks, poſſeſſes in *Aſia*: In all which the Mahumetan Religion is publickly Eſtabliſhed; but the Jewiſh and Chriſtian Religion are both permitted; and this laſt is divided into many Sects, as *Greeks*, *Armenians*, *Jacobites*, *Georgians*, *Maronites*, *Cophtites* and many others. The Roman Catholicks are not ſo numerous there, as the others are.

There are many Governours in the Turkiſh Empire called *Beglerbeys*, who have under them *Sangiacs*, that are as their Deputies or Lieutenants.

CHAP. III.

The Kingdome of PERSIA.

THE Empire of the *Perſians*, heretofore ſo Vaſt and Famous, has been ſubject to many Alterations. It was founded by *Cyrus*, and overthrown by *Alexander*. The *Parthians* drove his Succeſſors from thence, and maintained long Wars with the Romans; it was again reſtored under the Name of the *Perſian*, and ruined by the *Caliſes* the Succeſſors of *Mahomet*: Invaded by the *Tartars* under the powerful *Tamerlan*, and at length Raiſed again by *Iſmael Sophy*, to the State wherein now it is. It is called the Empire of the *Sophy* of *Perſia*; and is bounded on the Weſt by the Turkiſh Empire, on the Eaſt by that of the great *Mogol*, on the North by the *Tartars*, from whom it is divided by the River *Oxus*, now *Abiamus*; and on the South by the *Gulf* of *Perſia*, and the *Indian Sea*: In a word it Reaches from *Tygris to Indus*, and from the *Caſpian* to the *Perſian Sea*, containing

ſeveral

ſeveral Provinces, *Perſia*, *Suſiana*: *Parthia*, *Media*, *Aſſyria*, *Hircania*, *Paropamiſa*, *Margiana*, *Carmania* and *Gedroſia*, all which have loſt both their Names and Limits. The Metropolis of theſe States is *Hiſpahan* or *Iſaham*, a great and fair City containing many ſtately Palaces, where the *Sophy* keeps his Court and uſually reſides: It lies in *Parthia* now a days called *Hierak*: The other Towns of that Province are *Caſſan*, *Argiſtan*, *Jex*, *Saba*, and *Targazin*.

In the Province of *Perſia* now called *Farſy*, is the Town of *Siras*, which is taken for the Ancient *Perſepolis*, burnt by *Alexander*.

Suſiana, which is called *Cuſiſtan*, hath for its Chief City *Sus* formerly *Suſa*, the Imperial Seat of *Ahaſſuerus*.

Media now a days *Servan*, hath the City of *Tauris*, which is the *Ecbatana* of the Ancients.

Aſſyria, whereof the Turk poſſeſſes part, hath *Moſul* for its Capital, which is the Ancient *Ninive* the Metropolis of the *Aſſyrians*.

Hircania is called *Diargument*; its principal Towns are, *Mazandaron* and *Strava*.

Paropamiſa at preſent *Sableſtan*, hath *Candahar* for its chief Town, which gives alſo a name to all the Province.

Margiana or *Elſabar*, hath *Mexed* for its principle Town, where the Kings of *Perſia* are Interred.

Carmania hath *Chirman*, from which it takes its modern name, *Gedroſia* or *Circan* hath the Town of *Calamate*.

The moſt Remarkable Iſles of *Perſia* are in the Gulf of that Name; that of *Ormus* is near the *Sreights*, and hath a Town of the ſame name Ruined at preſent.

The Iſle of *Baharem* is famous, by reaſon that about it they fiſh for, and take the lovlieſt Oriental Pearls.

The *Sophy* of *Perſia* is *Mahumetan*; but follows the Doctrine of *Aly*, *Mahomets* Son in Law, whom the *Turks* reckon a Heretick. The *Perſians* are of their Prince his Sect, and civilized and poliſhed, and much of the humour of the *French*. The Chriſtian Religion is ſuffered there, and in *Hiſpahan* it ſelf there are Convents of ſeveral Orders, as bare-footed *Carmelites*, *Capuchins*, *Minims*, and many others.

CHAP.

CHAP. IV.

The Empire of the great MOGOL.

THE Ancients divided the *East-Indies*, into *India* on this ſide, and *India* on t'other ſide of *Ganges*. In the firſt, called now *Indoſtan* which lies between that and another River named *Indus*, is the Empire of the great *Mogol*. It hath to the North *Turqueſtan*, to the Weſt the States of *Perſia*, to the South the Territories of ſeveral Princes which we ſhall hereafter mention; and to the Eaſt the Kingdom of *Bengala*: It is divided into ſeveral Kingdoms, which carry generally the Names of their Capital Cities, as *Agra*, *Lahor*, *Delli*, *Kabul*, *Caximir*; but the Kingdom of *Sinda* hath *Tatah* for *Metropolis*. The uſual place of Reſidence of that Monarch is *Lahor*, his Palace is Magnificent, and he is the Richeſt Prince in the World in precious Stones. He is Mahumetan, and moſt of his Subjects follow the ſame Religion; but there are many Chriſtians and Idolaters amongſt them, and a Sect of *Pythagoreans*, who hold it a deadly Sin to eat any thing that ever had life; who are there called *Bannians*.

CHAP. V.

The other States of the EAST-INDIES, and what the PORTUGUESE and other Nations Poſſeſs there.

BEfore we proceed further, we muſt take a view of the other Kingdoms of the *Eaſt-Indies*, and of what the King of *Portugal* Poſſeſſes there, that we may not be obliged to come back to the ſame parts again. Theſe *Indies* have two Peninſules, which are divided by the *Bay* of *Bengala*. That which is on the Weſt ſide, contains the Kingdoms of *Decan*, *Onar*, *Barcelor*, *Canara* and ſome others, with the Coaſt of *Malabar*, in which are the Kingdoms of *Calicut*, *Cochin*, *Coulan* and others, all bearing the Names of their Capital Towns: They are Scituated on the Weſtern part of this Peninſule. Towards the Eaſtern, is the Coaſt of *Coromandel*,

where

where are *Negapatan*, *Maliapor* or St. *Thomas*, and the Kingdom of *Bisnagar*, *Narsingue*, *Golconde* and *Orixa*, which bear the Names of their chief Cities. The two Coasts of this Peninsule are divided by Mount *Gate* which ends at Cape *Comorin*. The Countrey scituated on this Mountain is called *Balagate*.

At the Entry of the other Peninsule, which is to the East, we meet with the Kingdoms and Cities of *Pegu*, *Siam*, *Camboia* and *Tunquin*; and in the Penninsule is the Kingdom of *Malacca*, with its City of the same Name, which is the Southermost Extremity thereof.

In the Entry of the other Peninsule, which is to the West, is the Kingdom of *Cambaya*, with a City of the same Name, and another called *Surrat*, which is very large, and a place of great Trade, and the Residence of our *English* President of *India*.

Thu Kingdam of *Bengala* is near the mouth of *Ganges*, between the States of the *Mogol* and *Pegu*.

The King of *Portugal* possesses the Isle of *Diu*, near the Kingdom of *Cambaya*, which has a Town of the same Name near the Kingdome of *Decan*, the City of *Goa*, one of the greatest Towns of the *Indies*, and the Residence of the Archbishop and Vice-Roy; some places on the Coast of *Malabar*, and on the other side he had heretofore *Maliapur* a considerable Town, where it is beleeved the Body of St. *Thomas* is. In the other Peninsule formerly he held *Malacca*, which the *Dutch* have since taken from him. Besides these, he hath several Islands, and some places in others which belong not wholly to himself.

CHAP. VI.

The Kingdom of CHINA.

SOme Authors make this Kingdom as big as all *Europe*, so vast is its Extent. It hath the Ocean to the East, *Cochinchina* to the South, and to the West the *Indies* and part of *Tartary*, which it hath likewise in the North, and from which it is seperated by that Famous Wall of Four hundred Leagues in Length. It is divided into Fifteen Provinces, the Names of which it is not very material to know: There are above Two thousand Cities reckoned to be in this great Kingdom, and of them *Peking* is the Chief and the Imperial Seat of their Kings. That Throne was overturned by the *Tartars*, who ruined this Empire, and possest the greatest part thereof; but the Natives have lately recovered their Liberty again and expulsed the Conquerers. *Nanquin*, *Xanton* and *Amus*, are the most considerable

ſiderable Cities, and the leaſt is as big if not bigger than *London*. There are in this Kingdom many Fair Navigable Rivers, the chief of which are the *Yellow* and the *Blew*, called in the *Chineſe Language*, *Caramoran* and *Janſaguiam*, and *Chincheo* that paſſes by the Stately City of *Amoy*. The *Chineſes* are Idolaters, and Worſhip the Heavens and Stars, with many Idols that they place in their Temples.

The Jeſuites have Converted many of them to Chriſtianity, and are very Active in making Proſelytes in thoſe Parts.

CHAP. VII.

TARTARY.

THE greater *Tartary* is one of the vaſteſt Regions of the whole Earth. It hath to the Weſt the States of *Muſcovy*, the Ocean to the North, to the Eaſt the Streights of *Anian*, or *Jeſſo*, according to ſome Maps, and to the South *Perſia*, *India*, and *China*. Several Princes have Dominions in this great ſpace of Land, and among others the Prince of *Niuche* on the Eaſt-ſide, who Invaded and Conquered *China*: But the moſt conſiderable of all is the *Great Cham*. One of his chief Provinces is *Cathay*, which ſome take for *China*, and its City of *Cambalu* for that of *Pequin*, ſo uncertain Men are in the knowledge of thoſe diſtant Countries. It is nevertheleſs ſure that there are Vagabond *Tartars*, divided into Societies called *Hordes*: They Inhabit that place which is called *Tartary Deſert*, near which is the Kingdom of *Aſtracan*, with a Town on the ſame Name on the *Volga*. In theſe Countreys, as 'tis reported, grows the *Boranetz*, which is a Plant Animal, that is, half a Plant and half an Animal: It is in Shape like a Lamb, and faſtned to a ſtalk, about which it Nibbles and Eats the Graſs, which once failing, it withers and dies. The other parts of *Tartary* are, *Turqueſtan* and *Zagathy*, the chief City whereof is *Samarkand*, the Imperial Seat of the Victorious *Tamerlan*. Moſt part of the *Tartars* are Mahumetans, there are many Idolaters, ſome *Jews*, and very few Chriſtians among them.

CHAP. VIII.

The Isles of ASIA *in the Ocean.*

IN treating of the Territories of the *Turk*, we spake of the Isles of *Asia* that are in the *Mediterranean*: We must now mention those in the Ocean which belong to that part of the World; but seeing they are so numerous, that a large Volume would be too little to describe them all in; we shall only touch at those which are the most considerable and of greatest Note amongst them.

The *Maldives* lie towards the Cape of *Comorin*, to the South and West thereof; there are many of them, and they reach to the Line, being divided into certain Parcels, which are called *Attollons*, and contain many small Islands, separated by verry narrow Channels; they are full of *Coco-trees*; the Inhabitants are Mahumetans, and subject to a King.

Zeilan or *Zeilon*, is near *Cape Comorin*, being Two hundred and forty Leagues in Circumference: The *Indians* call it *Tenasirim*, that is, a Paradice of Delights; there grows the Tree whereof Cinnamon is but the Bark, and that in such plenty, that there are whole Forrests of them: Fair Emeralds and fairer Elephants are likewise to be had there. Some would have it to be the *Taprobane* of the Ancients, which others think to be *Sumatra*. One of its chief Towns is *Sitavaca*, the Residence of a Prince who takes the Title of Emperor of *Zeilan*, to whom the other Kings are Tributary. It is divided into several Kingdoms, of which *Candy*, that is in the middle of the rest, is one of the chief. The *Portuguese* had formerly some places there, of which *Columbo* was the most Important: But at present the *Hollanders* are possessed of that and much more than ever the *Portuguese* had. The Natives are either Mahumetans or Idolaters.

Sumatra is divided by the Streights of *Sincapura*, from the Peninsula of *Malacca*. Most part of the Modern Geographers take it for *Taprobane*; the Equinoctial cuts it almost in the middle, it is very large, and some assign to it Thirty Kingdoms. Its chief Towns are, *Achein*, *Pedar*, and *Batham*: The Inhabitants profess Mahumetanism, and many of them are still Idolaters.

Great *Java* is near to *Sumatra*, and is seperated from it but by an Arm of the Sea, called the *Streights* of *Sonda*. This Island is about Two Hundred Leagues in Length, but not above Forty in Breadth: It is Subject to several Princes, who are Tributaries to another, by them called *Mataram*, that is to say, Emperour. It hath considerable Towns, such as *Bantam*, *Palambuam*, *Japara* and *Batavia*, called so by the *Hollanders*, being formerly

formerly called *Jacatra* : They took it in the Year One thousand six hundred and seventeen , and have strongly fortified it, and made it the Residence of their General, and Principal Seat of their great *East-India* Trade. The Inhabitans of the Island are for the most part Mahumetans.

Little *Java* is now called *Cumbava*, and but little known, some of its Inhabitans are Idolators.

Borneo lies to East of *Malacca* and *Sumatra*, and to the North of *Java*: This is one of the greatest Islands in the Ocean; it is almost round, and hath above 200 Leagues in Diameter. Its Principle Town carries its Name. Most part of the Inhabitans profess Mahumetanisme, and the rest are plunged in Idolatry.

Celebes is to the East of *Borneo*, and is much less than it, the chief Towns thereof are one that goes by the same Name and *Durate*.

Gilolo is to the East of the former, and is not so great; it hath a Town of its own Name, and another called *Tolo*.

The *Molucca*'s, so Famous for the Cloves, Nutmegs, and Mace, which they disperse through the whole World, lie under the Equinoctial, betwixt *Celebes* and *Gilolo*. The chief are *Ternate*, *Tidor*, *Motir*, *Machian* and *Bachian*. The *Portuguese* have had some places there, which have been disputed by the *English* and *Dutch*, and finally carried by the latter, who have Engrossed the Trade of those Rich Spices.

Banda is to the South of *Gilolo*, and furnishes also Nutmegs. The *Hollanders* have the Possession thereof.

The *Philippine Island*, called so by the *Spaniards*, in Honour of their King *Philip* the Second, are so many in number, that some Authors reckon above Ten thousand of them. They lie Northward from the *Mollucca*'s, and Eastward from *Cochinchina*. The greatest and most considerable of them is *Luconia*, where the Town of *Manilha* is. The other that are remarkable are those of *Mindanao*, which hath a Town of its Name, the Isles of St. *Juan*, of *Cebu*, *Matan* and *Tandayo*: Betwixt this last and the Isle of *Lucon*, is the Streights of *Manilha*, Famous amongst Navigators.

Amacao or *Macao*, is a small Island on the Coast of *China*, where the *Portguese* have a Town of the same Name.

The Isle *Formosa*, the *Lucaios*, and some others, are to the East of *China*.

The Empire of *Jappan*, is composed of several great Islands, on the the East of *China*, the chief of which is called *Niphon*, and its Capital Town *Meaco*; though this present Emperour hath his Court at *Jedo* in the East part of the Island. Many Jesuites have here lost their lives for Preaching Christ to that Idolatrous People. To the North of this Countrey the Land of *Jesso* hath been lately discovered, divided from it by the Streights of *Sangar*.

The chief Mountains of *Asia*, are *Taurus*, *Libanus*, *Caucasus*, and *Imaus*. Its chief Capes, are that of *Comerin* in the *Indies*, *Liampo* in *China*, *Fartach*, *Razalgate* and *Monzandaon* in *Arabia* the happy, and the Promon-

tory of *Tabin* in *Tartary*. Its principal Rivers, are the *Volga*, *Araxez*, *Oxus* now *Abiamus*, and *Jaxartes* or *Chesel*, which run into the *Caspian* Sea.

Euphrates and *Tigris* come from the Mountains of *Armenia*, embrace *Mesopotamia*, and uniting in *Chaldea*, fall into the Gulf of *Persia*. *Indus* comes from *Caucasus*, gives its name to *India*, which it watereth, and afterward runs into the Ocean, as *Ganges* does into the Bay of *Bengall*.

The *Cosmin* passes by *Pegu*, and the *Menan* by *Siam*, they both proceed from the Lake of *Chiamay*, and fall into the Ocean.

The Yellow and Blew Rivers are in *China*.

The *Tartar*, that is thought to have given Name to *Tartary*, runs into the Northern Ocean, and the *Oby* also.

It is to be observed, that the greatest part of *Asia* is in the Temperate Zone: It hath some Regions in the Torrid, to wit, part of *Arabia* the happy, and of the *Indies*; with many Isles. Some Countreys of *Tartary* are in the Frozen Zone. To conclude, *Asia* reaches from the Equinoctial to the Seventieth degre of North Latitude; and some of its Isles are Ten degrees beyond the Line.

CHAP. IX.

AFRICA.

THere is no need of crossing the Sea to go from *Asia* to *Africa*, since we have a passage by Land, which is the *Isthmus* of *Suez*, betwixt the *Red Sea* and the *Mediterranean*. Having passed that, we find at first sight *Egypt*, and proceeding from East to West, we shall in order find *Barca*, *Barbary*, and the Kingdoms of *Fez* and *Morocco*, that are washed with the Ocean. Afterward from North to South, we will meet with *Biledulgerid*, *Zahara*, the Countrey of *Negres*, *Guinea*, the Kingdom of *Congo*, the Countrey of *Caffres*, as far as the Cape of good Hope. Afterward going tovvards the North, we shall find *Zanguebar*, and some other Countreys; and then having visited those Regions that are in the heart of *Africa*, as *Nubia*, *Ethiopia*, and *Monomotapa*, we shall end with its Mountains, Capes and Isles.

CHAP.

CHAP. X.

EGYPT *and the Region of* BARCA.

WE shall view the Countreys of *Africa*, that lie upon the Ocean, after that we have seen those that are upon the *Mediteranean.*

Egypt, so famous both in Sacred and Prophane History; which speak so often of its *Pharaoh's* and *Ptolomies*, hath on the East the *Isthmus* of *Suez*, and the *Red Sea*; on the North the *Mediterranean*, on the West the Countrey of *Barca*, and on the South *Nubia* and *Ethiopia.* It hath not so many Towns at present, as it had heretofore. The Metropolis of it is *Caire*, a very great City on the right Bank of the River of *Nile.* On the other side of that River are to be seen those famous Pyramids, which were the Monuments of some Kings, and have been reckoned amongst the Seven Wonders of the World; and as in all probability they were the most ancientest of the Seven, so 'tis certain they are the only one remaining. *Nile* having washed *Caire*, divides it self into two Branches, which embrace the Countrey called *Delta*, from the Greek Letter Δ, which it resembles; these two Branches produce others, which made several Mouths to that River, some of which are stopt up. The other Towns are *Asna*, anciently *Siene*, towards the South *Alexandria*, heretofore the Capital City under the *Ptolomies*, preserves still in its stately Ruins, the Name of *Alexander* the Great, who founded it: It lies upon the Sea, and near the place where the Phare stood, which was one of the Seven Wonders. *Rosetta* and *Damieta*, are also upon the Sea, at two other Mouths of the *Nile.* All this fair Countrey is made wonderfully fruitful, by the over-flowing of the *Nile*, and is subject to the Turk: the Inhabitants are Mahumetans, but there are many Jews and some Christians among them.

The Region of *Barca* was anciently called *Cyrenaica*, and hath *Egypt* on the East, the Sea on the North; on the West *Barbary*, and the Desarts that carry its name, with *Lybia* on the South; its chief Town is likewise called *Barca*; the others are *Alberton*, *Patriarcha*, *Bonandrea*, *Berniche*, and some more. The People are Mahumetans, Subjects to the Turk.

CHAP.

CHAP. XI.

BARBARY, *with the Kingdoms of* FEZ *and* MOROCCO.

BArbary hath to the East the Countrey of *Barca*, to the North the *Mediterranean*, to the West the Kingdoms of *Fez* and *Morocco*, and to the South Mount *Atlas*, which divides it from *Biledulgerid*. Going from East to West we find the Kingdoms of *Tripoly*, *Tunnis*, *Algire*, and *Tremesin* or *Telensin*, with their chief Towns of the same Name. Near to *Tunnis* are to be seen some Ruins of the famous *Carthage*. In the Kingdom of *Algier* is *Bugie* and *Gigery*; and some other places that may be seen in the Map, but very little known to us. The People of that Countrey are Mahumetans, and subject to the Turk, and have for many Ages practiced Pyracy upon the Mediterranean, to the great Annoyance of the Christians Commerce.

The Kingdom of *Fez* has to the South *Morocco*, to the East the Kingdom of *Tremisen*, to the North the Streights of *Gibraltar*, and to the West the *Atlantick* Ocean; its chief Cities carries the same Name, and is a beautiful and stately Place; the Principal Mosque of it is above a quarter of a mile in circuit, and therein burn constantly Nine hundred Lamps. The other Towns are *Mahamore*, *Larache*, *Alcazer*, and *Tetuan*; (the two former belong to the King of *Spain*) and *Tangier* belonging to the King of *Great Britain*.

The Kingdom of *Morocco* lies to the South of that of *Fez*; its chief City bears the same Name, and is beautiful and large, though it hath lost much of its ancient Splendour. On the the Top of one of its Towers, are three Golden Balls, which are believed to be Enchanted. Next to *Morocco*, the Town of *Agmet* is the most considerable: These two Kingdoms belong to one Prince, who is called Emperor of *Morocco*; he is Mahumetan, and his Subjects are of the same Religion; but there are many Jews and Christians among them.

CHAP.

CHAP. XII.

BILEDULGERID *and* ZAHARA.

BILEDULGERID signifies a Countrey of Dates, because it abounds with Palm-trees, which bear that Fruit. The Ancients called that Region *Numidia*; it reaches from the Atlantick Ocean to *Egypt*, the space of a Thousand Leagues: Mount *Atlas* divides it from *Barbary* on the North, and *Zara* bounds it on the South. Its best Province is *Suz* on the Atlantick Ocean; the rest, which are *Tesset*, *Dara*, *Segelmesse*, *Zeb*; and some others, most of which take their Names from their Towns, are but little inhabited, by reason of the great inconveniences of want of Water, noxious Animals, and the barrenness of the Soil. *Za hara*, or the Desart, is the Ancient *Lybia*, and reaches from the Ocean to *Egypt*, and hath *Biledulgerid* to the North, and the Countrey of *Negres* to the South. There is hardly any thing there but Desarts and heaps of Sand, which being driven by the Wind, many times bury Travellers alive, and being heated by the direct Beams of the Sun, render the Air insupportably hot. However there are some places inhabited, as *Zanhaga*, *Zuenziga*, *Terga*, *Agadez*, *Berdoa*; and some others, so little known to us, that we can say nothing with any certainty of them. These People, as well as those of *Biledulgerid*, are Mahumetans, and some of them Idolaters.

CHAP. XIII.

The Countrey of Negres *and* Guinea.

THat Countrey which is called the Countrey of *Negres* or *Nigritia*, hath on the West the *Atlantick Ocean*, on the North the Desarts of *Lybia*, on the East *Egypt*, *Nubia*, and the Empire of the *Abyssins*; and on the South *Guinea* and the Kingdom of *Congo*: It is about a Thousand Leagues in length, and of a very considerable breadth. The River *Niger* waters it, and over-flowing like the *Nile*, renders it fruitful: It is divided into several Branches, whereof the two chief are *Senega*, *Gambao*, or *Riogrande*, which fall into the Ocean near *Cape de Verd*. That great Countrey is divided into several Kingdoms; of which the

the most remarkable are *Genehoa*, *Tombut*, *Senega*, *Gago*, *Gualata*, *Melli*, *Cano*, *Agadez*; and betwixt the Branches of the *Niger*, the Kingdom of the *Jaloffes* and *Gambea*. They have generally either given or taken their Names from their chief Towns. The People are of different Religions; a great many of them are Idolaters, and some few are Mahumetans; they are subject also to different Princes.

Guinea hath to the East and North the Countrey of *Negres*, in which some Geographers also place it, towards the West and South the *Ethiopick* Ocean. It contains the Kingdoms of *Sierra Leona*, *Sabon* and *Benin*. It hath no Towns of any note. The Coast there is called by several Names, as the *Grain Coast*, the *Quaqua Coast*, and the *Gold Coast*, upon which the English, Dutch, and some other Nations, have their Forts and Factories. The Natives drive a great Trade with the *Europeans*, who transport yearly into the *West-Indies*, several thousands of these wretched Animals, sold to them by their inhumane Lords, and sometimes by their own Parents, into perpetual Slavery. This Countrey abounds in Gold; the Natives for the most part are Idolaters, and some of them worship their Kings.

CHAP. XIV.

The Kingdoms of Congo, Cacongo, Angola, Malemba, *and* Mataman.

THese Kingdoms are by some Geographers placed in *Ethiopia*; but we distinguish them, because under that name the Countrey of the *Abyssins* is chiefly understood.

The Kingdom of *Congo* hath to the East the Empire of *Prester John*, to the North the Countrey of *Negres*, to the West the Ocean of *Ethiopia*, and to the South the Kingdom of *Angola*. It is divided into several Provinces, and its chief Town is called St. *Salvador*. Next to that the most remarkable are *Panbo*, *Batta*, *Sanho*, *Sunde*, *Pemba*, which take or give their Names to their Provinces. The River *Zaire*, that comes from a Lake of the same Name, runs through this Kingdom, with a Stream famous for its swiftness and breadth. That of *Coanza* makes the Isle of *Loanda* at its Mouth; there is another River likewise called *Lelunde*. In the Northern part of this Countrey, there are People called *Anzicams*, who are reported to eat Mans Flesh, which is sold in the Shambles, as Beef and Mutton with us.

When the *Portuguese* discovered the Kingdom of *Congo*, the Inhabitants of it were Idolaters, and worshiped the Sun, believing that the Souls of good Men after death, were carried to Inhabit about that glorious *Luminary*. Since that time many there have Embraced the Christian Religion.

The Kingdom of *Caconga* is to the Eastward of the former; and there is no Town observed in it.

That of *Angola* is to the South of *Congo*; its chief Town is *Dongo*: Here are the Mountains of *Cambambe* (Rich in Silver Mines) and *Cape* St. *Mary*.

The Kingdom of *Malemba* is to the East of *Angola*, and near the Lake *Zambre*; that of *Mataman* is to the South of it. The People of these Kingdoms are Idolaters, but the Jesuites daily endeavour their Conversion.

CHAP. XV.

Caffreria, Sofala, Zanguebar, *and some other Countreys.*

THE Countrey of the *Caffres* or *Hottentots*, named *Caffreria*, hath to the East and North *Monomotapa*, to the West and South the Ocean, and reaches to the Cape of *Good Hope*. Along the Coasts of it are good Ports. No Towns are to be seen here; the People are altogether barbarous, having neither Laws, Kings, or Religion. Near the Cape of *Good Hope* the *Hollanders* have planted a very Noble *Colony*, which supplies in great abundance all Necessaries to their Ships as they go and come from the *East-Indies*.

The Kingdom of *Sofala* is upon the Indian Ocean, its chief Town bears its Name, and is built in an Island made by the River of *Cuama*. Some Authors take this Countrey for the Land of *Ophir*, whither *Solomon* sent to fetch Gold for Adorning of that stately Temple which he Built.

Zanguebar is to the North of it, and extends it self upon the Indian Ocean, which it hath to the East, as far as the Kingdom of *Adea*, which it hath on the North side, and the Empire of the *Abyssins* to the West. It comprehends Six Kingdoms, to wit, *Mongalo*, *Mozambique*, *Angothe*, *Quiloa*, *Mombaza*, and *Melinde*; each of them having a Capital Town bearing its Name. The Inhabitants are Idolaters or Mahumetans, with some few Christians. The *Portuguese* possess *Mozambique* and *Mombaza* with some other places.

Continuing still Northward and along the Indian Sea, we find the Republick of *Brave*, consisting onely in one Maritime Town of the same Name, which was pretty Rich, before it was sacked by the *Portuguese*.

Next we find the Kingdoms of *Magadoxo* and *Adel*, with their Capitals of the same Name. the latter reaches to the Cape *Guardafuy* and the Streights of *Babel mandel* which Joyns the Ocean to the Red Sea.

The Kingdom of *Abex* is upon that Sea and under the *Ottoman* Empire. Its chief Towns are *Arguico*, *Doncale* and *Suguam*, all three Maritime.

If there be any other little States, they are so inconsiderable, that it is not worth our while to stop and view them, just when we are about to consider larger and more Famous Territories in the middle of *Africa*, whereof we have now Surveyed the Confines.

CHAP. XVI.

NUBIA.

NUBIA hath the *Nile* on the East; which divides it from *Ethiophia*, that is likewise to the South of it. The Countrey of *Negro's* on the West, and *Egypt* on the North. Its Metropolis of the same Name is upon the *Nile*, and the others deserve not the Name of Towns, being but pitiful Villages. The Inhabitants have been Christians, and according to some Authors are so still; but without any Exercise of Religio: of which they retain nothing but the shadow and confused Knowledge.

CHAP. XVII.

Ethiopia *or the Empire of the* Abyssins.

SOme Geographers divide *Ethiopia* into the Upper and Lower, and under this comprehend the Kingdoms of *Congo*, *Angola*, and some others, whereof we have treated; and those of *Monomotapa* and *Monœmugi*, of which we shall speak: And under the other they place the Empire of the *Abyssins*; but because this retains particularly the Name of *Ethiophia*; we shall use the same without perplexing our selves about that Division.

Ethiopia has to the North *Nubia* and *Egypt*, to the East, the Kingdom of *Abex* and *Zanguebar*, to the South *Monœmugi*; and to the West the Kingdome of *Congo*, and the Countrey of *Negro's*. That vast Tract of Land which makes the Empire of the *Abyssins*, is all in the Torrid Zone, and reaches almost from the one Tropick to the other. Its length from North to South, is Six hundred Leagues. The *Nile* crosses it, and forms therein a Famous Island, which the Ancients Named *Meroe*, and the Moderns *Gueguerre*.

This great State is divided into a great many Kingdoms or Provinces, which bear that Name. The next to *Egypt* is the Kingdom of *Cansila*, then streatching Southward, these following are to be seen, *Barnagasso*, *Tigremahon*, *Bagamidri*, *Amara*, *Roxa*, *Narea*, *Zet*, and several others which I mention not, as judging it useless to fill this Description with barbarous Names that are good for nothing: The Towns here are mean and inconsiderable, having neither beauty nor extent, with pitiful Houses built of mud or clay and straw, because there is but very little wood or lime in the Countrey. Nor hath the King of *Ethiopia* fixed upon any Town for his usual Residence, but goes from Province to Province; having all his Court lodging in Tents, of which he hath always Five or Six thousand carried about with him in his Retinue. This is an odd way of living, and yet he is one of the greatest Princes in the World; he hath vast and large Dominions, great Treasures, rich Furniture, and can send numerous and strong Armies into the Field. He is abusively called *Prester John*, his Subjects call him *Adubvegue*; which signifies Emperour, and some Moderns, *Negus*, as much as to say Monarch. That Powerful Prince and all his Subjects profess Christianity, but with some mixture of Jewish Ceremonies; for they retain both Circumcision and Baptism. Their Priests Marry, but yet they have Monks. They have a Patriarch who is the Head of their Church, whom they call the *Abuna*; and their Country is full of Monasteries.

CHAP. XVIII.

The Kingdoms of Monœmugi *and* Monomotapa.

THE Kingdom of *Monœmugy* hath to the North the Empire of the *Abyssins*, to the East *Zanguebar* and *Sofala*, to the South *Monomotapa*, and to the West *Congo*. *Sofala*, whereof we have spoken, depends on it, and belongs to the same Prince: His other Countreys are inconsiderable, and the Towns that are more so, are *Bef Agag*, *Camar*. To the Northward of this State rise above the Clouds the high Mountains of the Moon. The Inhabitants are almost void of all Religion.

The Kingdom of *Monomotapa*, hath the last Kingdom we spake of to the North, and on all other sides the Countrey of the *Caffres*. The chief City of it and Seat of the Prince is of the same Name; its other Towns are *Mogar*, *Mosata* and *Gale*. Under it are comprehended the Kingdoms of *Toroa*, *Inhambane*, and *Inhamior*. Its Inhabitants are Idolaters, whom the Jesuits labour to convert to Christianity.

This Rigion is watered with the Rivers of *Cuama* and *Spiritu Sancto*.

These are the more known Regions of *Affrica*, which yet are so little, so that what we can say of them deserves not the Name of a Description. The chief Mountains are, *Atlas*, *Sierra-Liona*, *Mount Amara*, and the Mountains of the *Moon*.

The chief Capes thereof are, Cape *Verd*, the Cape of *Good Hope*, and *Guarda-fuy*.

Its Rivers are the *Nile* that runs into the *Meditarranean*, after it hath watered *Ethiopia* and *Egypt*. The *Niger* that runs through the Countrey of *Negres*, and falls into the *Atlantick* Ocean near the Cape *Verd*, where it makes many Branches. The *Zambre*, that proceeds from a Lake of the same Name, runs through the Lake of *Zachaf*, and dividing it self into two Branches, one whereof is called *Cuama*, and the other *de Spiritu Sancto*, both whereof are discharged into the Indian Sea; and the River *Zaire*, which falls with great Impetuosity into the Ethiopian Sea.

CAHP. XIX.

The Isles of AFRICA.

IN the *Miditerranean* are first the Isle of *Malta*, the *Melita* of the Ancients, Famous for the Shipwrack of the Apostle St. *Paul*, and the Residence of the great Master of the Order of St. *John* of *Jerusalem*, which bears its Name: It is Seven Leagues Long, and Four Broad. Its Towns are the *Valette*, the City, the *Bourg*, and St. *Michael*, with the Castle St. *Elme*. The Isles of *Comin* and *Comminet*, *Forfora*, *Goze*, *Lampadosa* and *Limosa* belong likewise to the order of *Malta*.

The Isle of *Pantalarea* belongs to the *Portuguese*, and that of *Zerbi* to the *Turks*.

In the *Atlantick Ocean* are the *Canaries* that belong to the *Spaniards*, *Porto Santo*, *Madera*, and the Cape *De Verd Islands*, which belong to the Crown of *Portugal*.

Porto Santo is near to *Madera*, and in respect of it inconsiderable, for *Madera* is large and fruitful, producing good Wines, and that Sugar which goes by its Name. The chief City of it is *Funchall*, and has a Bishop *Suffragant* to the Archbishop of *Lisbonne*. The People are Civil and Roman Catholicks.

The

The *Canaries*, which the Ancients called the *Fortunate Islands*, because of the goodness of the Air and Soil, are to the West of the Kingdom of *Morocco:* they reckon Seven of them, that are the chief; to wit the *Grand Canaries*, the Isle of *Ferro*, the Isles of *Taneriffe*, *Lacerotte*, *Palma*, *Gomera*, and *Fort-ventura.* The great *Canary* which hath given its Name to all the rest, and got it from the abundance of Dogs that were found there, hath a Town of the same Name which is a Bishoprick.

The Island of *Ferro* is considerable, for that we have from thence taken our beginning of Longitude, it being the most Westerly of these Islands. There is here a Tree which so condenses the Air, that it furnishes the Inhabitants with Water, which is otherwise scarce enough with them.

Taneriffe is remarkable for a great Mountain, which is thought to be the highest in the World; called by the *Spaniards Pico*: from thence we have the best Canary Wine.

The rest are but inconsiderable.

The Cape *De Verd* Islands, so called, because they are opposite to that Cape, were known to the Ancients by the Name of *Hesperides*, *Gorgoniæ*, and *Gorgades:* The chief of them are Eight, to wit, St. *Anthony*, St. *Vincent*, St. *Luce*, St. *Nicholas*, St. *Jago*, *del Sal*, *Mayo* and *Fuego.* That of St. *Jago* or St. *James*, is the most considerable. It hath a City of the the same Name; the Bishop whereof is Suffragant to the Arch Bishop of *Lisbon*: Its other Towns are, *Ribera* a great place and much frequented, St. *Thomas*, St. *Michael*, and *La Praya* which is its best Port. The Air of this Island is extreamly bad.

In the *Ethiopick* Ocean and near *Sierra-Liona*, are the little Isles of *Farellon* and *Massacoya.*

Somewhat farther in the bottom of the Bay or Bight of *Guinea*, is that of St. *Thomas*, discovered on that Saints day whose Name it bears. It is directly under the Equinoctial: Its chief Town is *Pavoasan*, Inhabited by the *Portuguese.*

The *Princes* Island is near to the former, and was so called because the Revenue thereof was appointed for the use of the Eldest Son of the King of *Portugal.*

The Isle of *Farnandopo* is to the North of that, and near the Coast of *Guinea* and the Kingdom of *Benin.*

Beyond the Line we find the Isle of *Annobon*, which last the *Portuguese* called so, because they discovered it on New-years day.

The Isle of *Ascension*, discovered on Ascension day, and therefore so called, is farther to the South in the *Ethiopick Sea*, and is neither inhabited nor habitable for want of Water, but it is abounding in Turtle or Sea Tortoise. St. *Helena*, for a like reason so named, is of all the Islands in the World the most Remote from the Continent, being about Four hundred Leagues distant from it. It hath excellent Fresh Water, and so Salubrious an Air, that the Sick who land there, recover their Health quickly. It belongs to the English, and all the Ships that come from the *East-Indies* and belong to *England*, do commonly put in and take Fresh Water there.

In

In the ſame Ocean, and towards the Cape of *Good-Hope*, are the ſmall Iſlands of *Elizabeth*, *Cornelia* and *Fera*.

Beyond that Famous Cape, and to the Eaſt of *Africa*, in the *Indian Sea*, lies the Iſle of *Madagaſcar*, called alſo of St. *Laurence*, or of *Laurence Armeide* who diſcovered it, in the year One thouſand five hundred and ſix, on the day of St. *Laurence*. It is one of the greateſt Iſlands in the World; containing about Six hundred Leagues in Circuit, Two hundred and ſixty in Length, and in ſome places an Hundred in Breadth. Its Length reaches from North to South, from the Eleventh Degree of South Latitude, to the Five and Twenteth, ſo that it is almoſt altogether in the Torrid Zone, the Southern end of it being onely without it; over which the Tropick of *Capricorn* paſſes. It is very probable, that they who have taken this for the *Cerne* of *Pliny* and the *Menuthias* of *Ptolomy* are miſtaken, and that the Ancients never knew it. It hath no Towns, only Villages beſet with Stakes, the faireſt of which is *Fauzaire*. The Inhabitants have little or no Religion, they have neither Temples nor Altars; they Fear a God, but Worſhip him not. The *French* have made ſome Voyages thither, and printed Relations of the ſame

There are many little Iſles about this, of the chief whereof we ſhall only ſpeak. To the Eaſt of it are the Iſles of St. *Mary*, of *Bourbon*, *Maurice*, and *Diego Roiz*. To the North, *Gade*, *Agulha* and *Natal*. To the Weſt, *Mohila*, *Camora*, *Mayota*, *Johanna*, and St. *Chriſtophers*.

Near the Coaſt of *Zonguebar* is an Iſland of the ſame Name, having to the South the Iſle of *Monſia*, and to the North that of *Pemba*.

Near the Cape *Guardafuy* lies *Zocotora* with a Town of the ſame Name. This is the *Dioſcorides* of the Ancients; it produces the beſt Aloes and Dragons Blood; between this and the ſaid Cape lies another Iſland, called *Abba del Curia*.

It is to be obſerved that the greateſt part of *Africa* is in the Torrid Zone, and that the Line cuts it ſo exactly in the middle, that it reaches as far to the South, as it does to the North of it, that is to the Five and thirtieth Degree of South and North Latitude; however the much greater part is to the Northwards.

The End of the Second Book.

A NEW GEOGRAPHY.

The THIRD BOOK.

CHAP. I.

AMERICA.

WE are now come to the New World; for so Men hath been pleased to call this Continent which is divided from *Europe*, *Asia* and *Africa*, because it hath not been knowen to us much above an Hundred and four score years. It is held, that *Christopher Columbus* a Native of *Genoua* first discovered it in the year One thousand four hundred ninety two; yet it carries not his Name, but that of *Americus Vespucius* a Florentine, who five years after *Columbus*, in the year One thousand four hundred ninety seven, discovered *Brasile*; which was the cause that all that part of the World is called *America*. It is likewise called the *West-Indies*, in distinction from the *East-Indies* in *Asia*. It hath to the East, the Sea called the *North* Sea, *Mar del Nort*, to the West the South or *Pacifick* Sea, to the South the Streights of *Magellan*; but its bounds to the North are

are unknowen to us, and we cannot tell whether there be Seas or Lands. By the *Isthmus* of *Panama*, which makes it two Peninsules, it is divided into the North and South *America.*

In North *America*, and on the North Sea, are *Estotiland*, *Greenland*, *Terra de Laborador*, *Canada*, or new *France*, *New England*, *Maryland*, *Virginia*, *Carolina*, *Florida*, *New Spain*, *Jucatan*, *Honduras*, *Nicaragua*, *Costarica* and *Veragua*. And on the *Vermilian* Sea, *Anien*, *Quivira*, and *New Mexico.*

In South *America* are *Golden Castille*, *Guiana*, *Brasile*, *Plata*, and *Terra Magellanica*, all upon the North Sea, and on the South or *Pacifick* Sea, *Chili*, and *Peru*; and *Tucuman* in the middle.

CHAP. II.

North AMERICA.

ESTOTILAND, *Greenland* and *Terra de Labrador* or *Laborador*, have no Inhabitants but Savages, who live amongst Ice and Snow, with which these Countreys are covered. The Reader must not expect Towns here, for there are none at all: We are only to observe that *Greenland* is a Countrey lately discovered, and that there was another of the same Name, which cannot now be found; though the Kings of *Denmark* to whom it belonged, have in vain sent Ships in search of it. It had Towns, with Churches, and Monasteries; but no body can tell what is become of it: whether the passage to it be blockt up by the Ice, or that it hath been swallowed up in the Ocean.

Canada is called *New France*, because the French discovered and planted a Colony in it; the chief places thereof are *Quebec*, and *Tadoussac*, upon the great River of St. *Laurence.*

New England is a Rich and Flourishing Countrey, with many Towns, the chief thereof is *Boston*, Inhabited by the *English.*

Maryland is Peopled by the King of *Great Brittain*'s Subjects, and belongs to the Lord *Baltimore*, who holds it of that Crown.

Virginia was so called by the English, because they discovered it in the time of Queen *Elizabeth* who was never Married. In it is *James* Town, and some others; the principal product of this Countrey is Tobacco, which from hence is carried into most parts of *Europe.*

Carolina is a late Plantation of the English, not fully settled as yet.

Florida was so Named by the *Spaniards*, who discovered it on Palm Sunday. It stretches to the South in form of a Peninsule: In it are the Towns

Towns or Villages of St. *Mathew*, St. *Augustine*, and the River of the Holy Ghost.

New Spain is one of the lovelieſt Provinces in this New World. There ſtands the City of *Mexico*, which gave the Name to a great Empire, whereof *Montezuma* was the laſt King. *Fernando Cortez* Invaded it, in the year One thouſand five hundred and nineteen, took that Prince, and Conquered his Countrey. There are many other Towns in that Countrey, the chief whereof are, *Mechoacan*, *Los Angelos*, *Vera Crux*, *Valladolid*, and *Guatamala*. *Mexico* the Capital ſtands upon a Lake, it is large and well peopled, being the Reſidence of a Vice-Roy, and Seat of an Archbiſhop.

Jucatan is a Peninſule on the Bay of *Mexico*, the chief Town whereof is *Merida*.

Honduras has the Town of *Truxillo*.

Nicaragua hath *Cartagen*, and *Veragua* and *La Conception*. Theſe Three laſt Provinces and *Coſtarica*, lie between the South Sea and the Bay of *Mexico*.

Anien is onely remarkable for the Streights that carry its Name, which are by ſome thought to be fabulous; and runs between *California* and the land of *Jeſſo*: this land is ſuppoſed to ſtretch far out into the Weſt, and is ſeperated from *Aſia*, onely by ſome branches of the Sea, and from *Japan* by the Streights of *Sangar*.

Quivira was called New *Albion* by Sir *Francis Drake* Admiral of an Engliſh Fleet, who diſcovered that Countrey in the year One thouſand five hundred and ſeventy nine: it lies on the *Vermilian* Sea, that divides it from *California*; but there are no Towns obſerved in it.

New Mexico contains *New Granada*, wherein is the Town of *Staffe*.

CHAP. III.

South AMERICA.

UPon the Iſthmus of *Panama* are two Towns, whereof the one that gives it the Name, is upon the South Sea, and the other, which is upon the North, or rather the Bay of *Mexico*, is called *Nombre di dios*. Beyond that ſpace of Land, which lies between the two Seas, are the following Regions on the North Sea.

Golden Caſtille, ſo called from that precious Metal which is found there in abundance. Its chief Towns are *Carthagena*, St. *Martha*, and St. *Fe de Bogota*.

To the Eaſt of that is the Countrey of the *Caribbes*, in which is the

North Cape, well known to those that Sail in these Seas. The Inhabitants go stark Naked, and have neither Government nor Religion.

Guiana is to the South; it hath a Town called *Manoa*, and by the Spaniards *El Dorado* (because there is much Gold in it) with a Lake of a vast extent, almost under the Line. Some affirm that there are a kind of Monstrous People in that Region, who have no Heads, and have their Eyes in their Shoulders, and their Bellies; but that is only learnt from the report of their Neighbours, who heretofore told it to Sir *Walter Raleigh*, Admiral of an English Fleet under Queen *Elizabeth*. We are not to believe all that we are told, neither are we to deny all that we cannot believe. The truth is, that report of Men without Heads is very strange, and seems contrary to the order of Nature, which is not guilty of so considerable mistakes, as to fail in the production of a whole race of People. Sometimes she produces Monsters, because she meets with bad Dispositions that hinders her Operations; but as if she repented of what she had done, and would disown such imperfect works, she puts a stop to the progress, and suffers them not to propagate and beget others like themselves.

Brasile streches on the North Sea, from the River of *Amazones* to the Region of *De la Plata*. The People go there stark Naked, neither sow nor reap, but live on the Natural Fruits of the Earth, which are very plentiful in their Region, and by Hunting and Fishing. They eat the Prisoners they take in War, rather to satiate their Revenge than their Appetite. They have no Prince, no Laws, nor Religion; and they believed not that there was a God, until they were instructed by the Europeans, with whom they conversed.

The Portuguese, English, and Hollanders, have had Plantations there, and sometimes Wars for their Titles. In that Countrey are the Towns of St. *Salvador* or *Baie*, on the famous Bay of *Todos los Santos*, *Pernambock*, *Rio Janeiro*; and several others. But let us not leave this fair Countrey without viewing the most pleasant and biggest River of the World, that watereth it: It is called the River of *Amazons*, because some Women carrying Arms and Fighting, were observed upon the Banks thereof. It is likewise called *Orellane*, from a Spanish Captain that failed long upon it. It springs from the Mountains of *Peru*, and carries its Streams through that Countrey into *Brasile*; where after a course of Six hundred Leagues long, it pays the Sea the largest tribute that it any where receives. Its Mouth, in the opinion of some, is Fourscore Leagues over; and just under the Line it mingles with the North Sea.

The Region *De la Plata* is to the South of *Brasile*, and on the North Sea; it is refreshed by a River that gives it both its Name and Water. The Portuguese have called it *Rio de la Plata*, that is, the Silver River; because Silver is found amongst the Sands it brings with it. On the side of it is the City of *Assumption*; the others are St. *Foy* and the *Visitation*.

The Countrey of *Chica*, and that of *Patagons*, which borders on the Streights

Streights of *Magellen*, are to the South beyond *La Plata*, Here are no Towns, some Capes and famous Ports, as the Port *Desire*, and the Cape *De las Virgines*. It is true, that on the Streights are to be seen the Ruin of a Town called *Philippa*, built by the Spaniards, where they were almost all starved.

The most remarkable thing in this Region, is the People that inhabit it, and are called *Patagons*; they have been reported to be Ten or Twelve foot high, and to swallow down a Pail full of Wine, with as much ease as an ordinary Man one Glass. They cover themselves with Beasts Skins, and carry Clubs, Bows and Arrows. They lay their Dead upon little Hills, and cover them with heaps of Stones, lest Beasts should devour them. It hath not been observed that they have any Laws or Religion. In a word, they are Barbarians, and for Strength and Bulk of Body, some what exceed our European, but our latest Discoveries will not permit them to be Giants.

Having passed the Streights that were called after *Magellan*'s Name who discovered it, and has eternized himself thereby; we find on the South Sea Cape *Desire*, and advancing from South to North, *Chili* and *Peru*.

The Country *Chili* hath these chief Towns, St. *Jago*, *L' Imperial*, *La Conception*, and *Baldivia*.

Peru is is to the North of *Chili*, and reaches Five hundred Leagues from South to North; it has to the West the South Sea, to the East the high Hills, which the Spaniards call *Las Cordilleras*, or the *Andes*, perpetually covered with Snow, in the midst of the *Torrid Zone*. when *Pizarro* and *Almagro* arrived in that Countrey, in the year One thousand five hundred and twenty five, it was subject to the Princes named *Ingas*, who had settled a powerful Empire in those Places, extending above Fifteen hundred Leagues in circuit; they had governed there above Six hundred years, when the Avarice and Ambition of those two Spaniards promoted them to dethrone the last that swayed that Scepter; his Name was *Atabualpa*, or *Atabalipa*, whom they took and caused to be strangled Here they found a prodigious quantity of Gold. The Inhabitants were Polite and Civil, they worshipped the Sun, and believed there was another God Superior to him, whom they called *Pachacamac*. The City of *Cusco* was the Imperial Seat of the *Ingas*. The second in Dignity was *Quito*, situated almost under the Equinoctial; both which remain still. The Spaniards have built many there, the most considerable of which is *Lima* on the Sea side, with a Port. This is the Residence of a Vicroy and Archbishop. The other chief Towns are *Arica*, *Arequipa*, St. *Miguel*, on the Sea, and in the Inland *Potosi*, near the famous Mountain of the same Name, wherein are inexhaustible Mines of Gold and Silver; *La Plata*, so called for its Silver Mines, *San Juan del Oro*, and some others.

The Original Natives of this Kingdom, have for the most part been extirpated by their Conquerors; and those that were not, were converted to the Catholick Faith: so that there are several of them Suffragant Bishops to the Archbishop of *Lima*.

The Countrey of Cinamon lies betwixt *Peru* and *Guiana*; it was so called, by reason that there were Trees found there, whose Bark had a great affinity to the true Cinamon. There are no Towns nor Villages observed there.

Tucuman is between *Chili* and the Region *De la Plata*, and hath St. *Jago del Estero* for its chief Town.

We must now see what are the Mountains, Capes, Rivers, and Streights of this New World.

Its chief Mountains are the *Andes*, or *Las Cordilleras*, which lie to the East of *Peru*. The *Ingas* caused ways to be cut out in them, which surpassed all that the Roman Grandure ever could do. They filled up deep Valleys, and cut through high Rocks; the remains of which prodigious Works are still to be seen.

In *Mexico* the Mount *Popochampeche* continually casts out Flames. The most famous Capes, are Cape *Breton*, Cape *Florida*, the *North* Cape, and that of St. *Augustin*.

Its greatest Rivers are that of St. *Lawrence* in *Canada*, of the *Holy Ghost* in *Florida*, *Oranoka*, *Maragnon*, the River of *Amazones*, and *Rio de la Plata*, in South *America*; all which run into the North Sea; no considerable Rivers fall into the South Sea.

The most noted Streights are towards the North, those of *Davies* and *Hudson*; towards the South the Streights of *Magellan*, *Le Maire* and *Brouvers*, of which we shall speak, after that we have considered the Islands that lie about this Continent.

CHAP. IV.

The Isles of AMERICA.

WE shall in the first place view the Isles of the North Sea, which are the most considerable; for there are but very few in the South Sea, and we shall proceed from North to South.

New-Foundland is an Island near the Bay of St. *Lawrence* and Land of *Canada*; upon the Banks of which there is a great Cod-fishing.

The

The Isles of *Assumption* is in the Bay of St *Lawrence*, and the Sandy Island, to the South of *New-foundland*.

The *Bermudas* are in the middle of the Ocean, and the *Bahaman* Islands to the East of *Florida*.

Cuba lies to the South of them, and upon the Mouth of the Bay of *Mexico*; it is above Two hundred Leagues in length, and about Threescore in breadth: St. *Jago* is its chief City, and an Episcopal Seat. Next to that is the *Havana*, where the Spanish Flota Rendevouze, , and meets on their return homeward from *America*: it lies on the West of the Island, and almost opposite to Cape *Florida*.

Hispaniola, called likewise St. *Domingo*, and by the Natives *Haity*, is about Three hundred Leagues in circumference, and lies Eastward from *Cuba*. The Capital City, which gives it the Name, is St. *Domingo*; the Residence of a Viceroy, and Seat of an Archbishop. The object of Avarice is found there, I mean Gold and Silver Mines. The Spaniards have dispeopled these two Islands and banished the Natives, as they did from most of the others.

Jamaica lies South from *Cuba*, and belongs to *England*; the Two chief Towns of it are St. *Jago de la Vega*, otherway called the *Spanish Town*, by whom it was built, and *Port Royal*, or the *Point*, built by the English, and an excellent Harbour; the Governour of the Island resides in the former. It is rich and in a flourishing condition.

St. *John de Portorico* is to the East of *Hispaniola*; its chief Town, which is that of St. *John*, has an excellent Harbour. This Island was formerly called *Boriquen*.

The *Caribbe* Islands are to the East of the former, and, as it were, at the Mouth of the Gulph of *Mexico*, which they seem to shut; they lie ranked in form of a Crescent, and reach from North to South. The most remarkable of them are *Barbadoes*, St. *Christophers*, *Guadalupe*, *Dominico*, *Martinico*, *Antego*, *Grenada*, and the *Trinity*. The English, Dutch, and French, possess most part of them.

Margareta lies somewhat more Westerly; and the Fishing of Pearls, which gave it its name, renders it famous.

The Natives of these Islands, as in many places of the main Land, were Man Eaters or Canibals, but at present the greatest part of them are destroyed, or forced to seek some other way of living.

The Isle of *Cayenne* is near the main Land, upon the Coast of *Guiana*, an Island made by the Mouth of a River called also *Cayenne*. The French had settled there and printed Relations of it, but in the late Wars the Hollanders dispossessed them, and have planted a Colony of their own. The Isle of *Maranhaon*, is also at the Mouth of a River that likewise carries the same name.

The South Sea has very few Islands near to *America*, these are only found there:

Mocha

Mocha, on the Coast of *Chily*, is an Island of some consideration. *California* hath been long taken for a Continent, but it is at length found to be an Island supposed to be divided from the Land of *Jesso*, by the Straits of *Anien*, and from *New Granada*, by a pretty large Channel, which is called the Vermilian Sea.

The Isles of St. *Thomas*, *Nublada*, and *Rocapartida*, are to the South of *California*.

The Isles of *Salomon* are in the middle of the South Sea, towards the Coasts of *New Guinea*.

And now you have, Reader, what we thought fit to speak of this New World. When it was discovered, the Inhabitants were either plunged in Idolatry or void of all Religion. Of this kind were the People of *Brasile*. Those of *Mexico* worshiped Idols, and Sacrificed Men unto them; they plucked out the Hearts of those wretched Victims, and threw them at the Feet of their Gods, made of Gold and Silver.

The People of *Peru* were more moderate in their Worship, their Sacrifices were not so cruel; they chose for their God the most Glorious of all the Lights of Heaven, but they believed him not the Almighty, for they assigned a Father and Soveraign to him, as well as to all other created Beings, and called him as we have already said, *Pachacamac*. But it is strange, that in all this vast Continent there was no trace of Christianity to be found; all of them were ignorant of that, yea, and of a matter of far less importance, though of great use, I mean of writing. They could not conceive how a piece of Paper could convey the words and thoughts of People at a great distance to one another. We may affirm that these Countreys are every way far distant from ours. The Beasts, Plants, Flowers and Fruits, are quite different from what are amongst us; and the People of *Europe* imparted theirs to them, with the Religion that they profess.

CHAP. V.

The TERRA AUSTRALIS.

WHen *Magellan* passed the famous Streights that is called by his Name, on his left hand to the South, he observed a Land that shone with multitudes of Fires, and therefore he called it *Terra del Fuego*. He took it for a Part of the *Terra Australis*; but *Le Maire* having discovered another Streight in the year 1616, which carries his Name also, perceived that that Land of Fire was but an Island,

and

and obſerved another on his left hand, that he named, *Statenland*, which in his Language ſignifies, the Countrey of the States *Brouvers*, who found another Streight more Southward than that of *Le Maire*, in the year One thouſand ſix hundred and forty three, hath diſcovered the Countrey of the States to be likewiſe an Iſland.

Betwixt the 30 and 40 degrees of South Latitude, and the 210 and 220 of Longitude, ſome late Maps mark a Countrey which they call *New Zealand*, diſcovered in the year One thouſand ſix hundred and fifty four.

Under the ſame Latitude, but between the 160 and 170 degrees of Longitude, they mark another Land, diſcovered in the year One thouſand ſix hundred and fourty two, called *Antony van Diemanland*: Under the ſame Longitude, and the Tropick of *Capricorn*, they place a Countrey called, *New-Holland*, diſcovered in the year One thouſand ſix hundred and forty four.

New Guinea is near the *Molucca's*, but it is believed to be an Iſland, and it is not certain whether the Lands we have juſt now named, be Iſles or parts of the Continent.

To the South of the Cape of *Good Hope*, it is ſuppoſed that there is Land, and ſome have called it the *Land of Parrets*. They talk of ſome Kingdoms there, but all the knowledge we have of thoſe Countreys is very uncertain; for no progreſs has been made into them: ſome ſmall Touches of the Coaſt have only been diſcovered. Time and Induſtry may poſſibly afford us greater Diſcoveries.

CHAP. VI.

The Land near the ARCTICK *or* NORTH POLE.

ABout this Pole are *Greenland*, *Nova Zembla*, and *Spitzberge*, with ſome other Countreys, of which we know very little. It is certain that ſome have ſailed within Eight degrees of the Pole; and it is affirmed that the Hollanders have been under the very Pole: but with what truth I ſhall not adventure to ſay.

It is thought by ſome, That about that place, *America* is joyned to the Con-

Continent, either on the side of *Asia*, or of that of Europe; but nothing of it is yet certain.

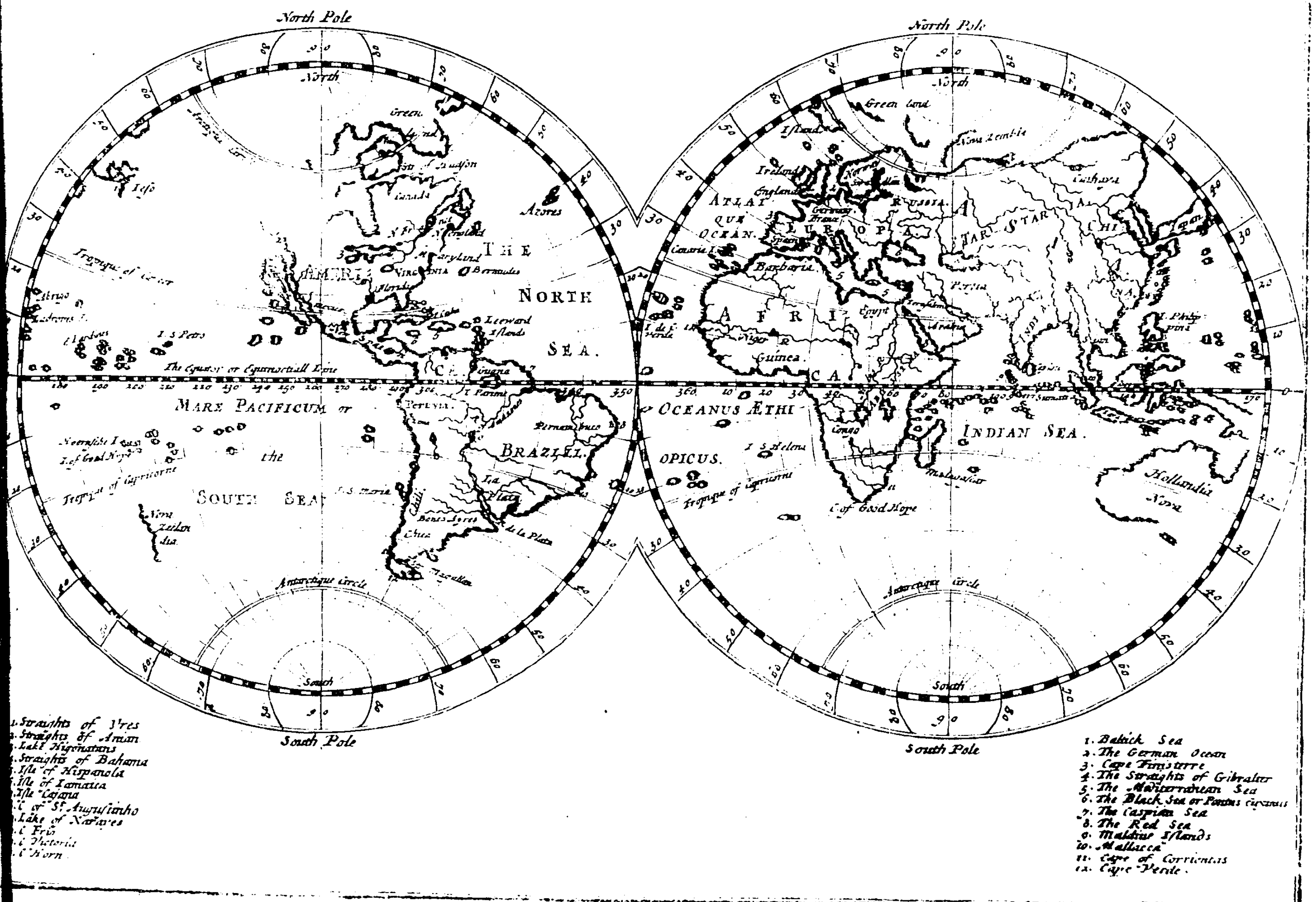
It is to be observed that *America* reaches North, to the 70 degree or farther, and South to the 52 or 53 degree of Latitude; so that it lies partly in the Torrid Zone, partly in the North and South temperate Zones, and partly in the Northern Frozen Zone.

Thus, Reader, I have given you a short and as exact Description of the Earth, as I could, and have said nothing but what I thought true.

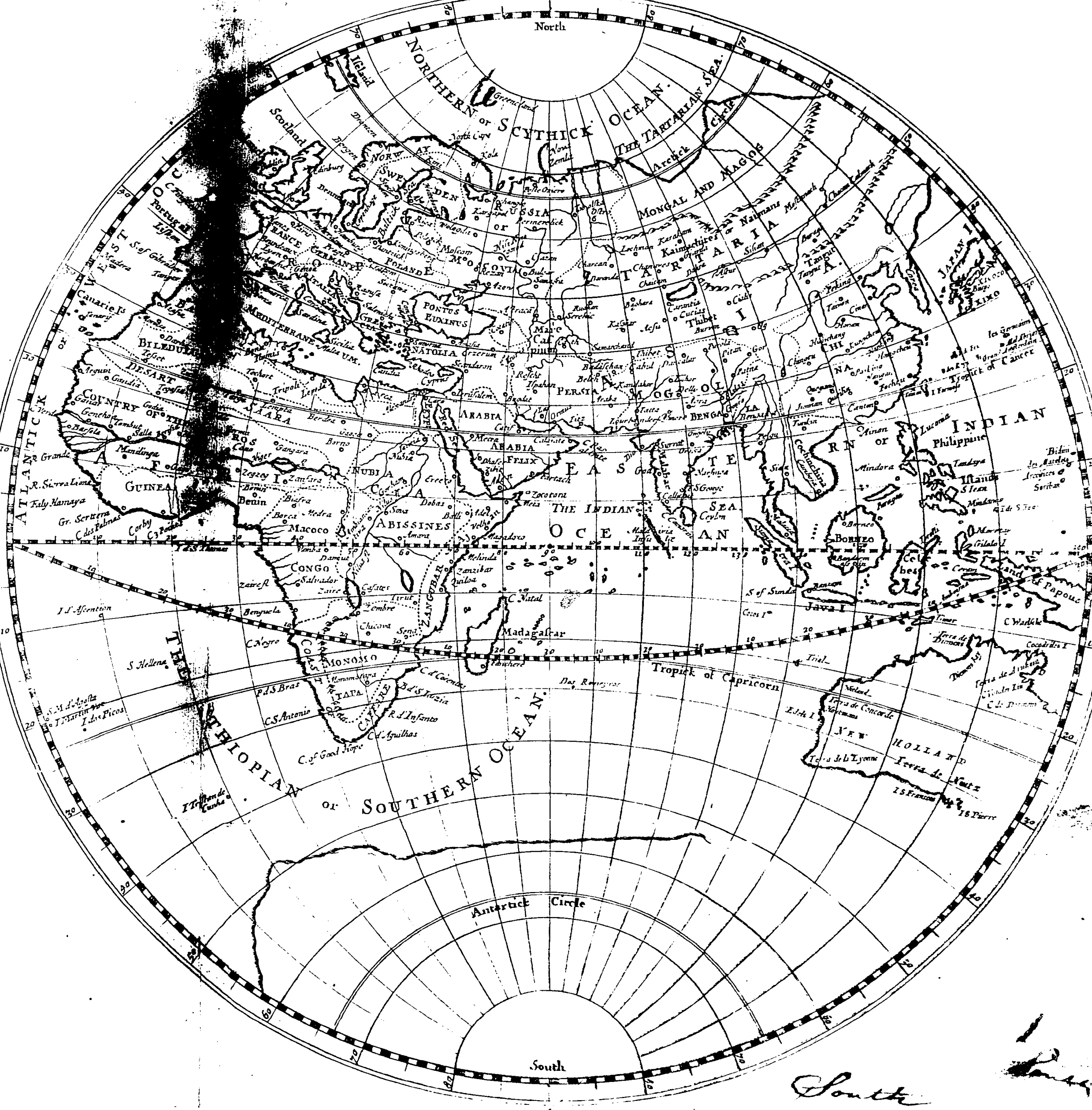
The little knowledge that we have of the Inland parts of these quarters of the World, together with the uncertainty of the Relations of different Travellers, made me unwilling to impose upon you for truth, those things that I was not well satisfied in my self; which has rendred this Treatise possibly, more short than the Vast tract of Land it pretends to describe, may seem to require.

FINIS.

THE WORLD IN PLANISPHERE.



North



Ind

South

Circulus Arcticus
AMERICA SEPTENTRIONALIS
Tropicus Cancri
Circulus Æquinoctialis
Tropicus Capricorni
Circulus Antarcticus
AUSTRALIA INCOGNITA
MAR DEL NORT
MAR DEL ZUR
MARE PACIFICUM
AMERICA MERIDIONALIS
Baffins B
C Farewell
Bermudas
FLORIDA
Bay of Mexico
Jamaica
Panama
PERU
BRASIL
Guiana
PARAGUAY
Buenos Ayres
R de Plata
Fretum Magellanicum
NEW GUINEE
NEW ZELAND
TERRA QUIR
Diemens Land
Tropicus Canceri
Terra de Campaigne
IAPAN
ASIÆ PARS


SPAINE
FRANCE.
Monts Pirenees
BISCAIE.
Asturia.
Navarre
ARRAGON.
CATALOGNIE.
GALICIA.
LEON
OLD CASTILLE
NEW CASTILLE
PORTUGAL
ANDALOUSIE.
GRENADE
VALENCE.
Murcie
Algarve.
OCEAN.
MEDITERRANEAN SEA.
The Strait of Gibralter
C. d'Ortegall
C. d' las Pennas
C. d' Machichaca
Corunna
Compostelle
Oviedo
Bilbao
S. Sebastien
Bayonne
Pampelun
Narbone
G. de Leon
Perpignan
Rosillon
Burgos
Leon
Astorga
Zamora
Valladolid
Numance
Soria
Osma
Douero R.
Calataiud
Darosa
Saragossa
Ebro R.
Huesca
Lerida
Cordone
Girone
Vich
Roses
Barcelone
Tarragone
Tortose
monserrat
Bayonne
Cape d' Palafagel
Salamanque
Rodrigo
Abila
Villa Franca
Braga
Coimbra
mondego R.
Alcala de Henares
Madrid
Toledo
Huetta
Calanda
Albarazin
Teruel
Xebra
Segorbe
Sagontum
Valence
Cullera
Cape d' Cullera
Xativa
Denia
Alicante
Cape martin
Coria
Placentia
Tage R.
Alcantara
Truxill
Merida
C. Real
Malagon
Cuenca
St. Cruz
Lisbone
C. Sintra
Setuval
Evora
Beja
Elvas
Badajox
Guadiana R.
Aromes
Cordoue
Ubeda
Guadalquivir R.
Ecija
Lucena
Granade
Guadix
Lorca
Murcie
Cartagene
C. de Palos
Almeria
Almazara
C. de Gates
Seville
Xeres
Palsos
S. Lucar
Ronda
P. Real
Cadis
medina Sidonia
Gibraltar
Marbello
malaga
Velez
Salobrene
Tariff
Tanger
Ceute
Faro
Silues
C. S. Vincent
Montcolibre
I. minorque
I. Maiorque
Port mahon
Yuice
Formentara
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FRANCE.
Leagues
6. 12. 18. 24. 30.
THE OCEAN
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Plymouth
Scilly I
Lands End
Calais
Flandre
NORMANDIE.
BRETAGNE.
CHAMPAGNE
LORRAINE
Strasbourg
BEAUCE.
Orleans
Fontaine bleau
ANIOU
Nantes
Rennes
Brest
Morlaix
Tours
TOURAINE
Bourges
BERRI.
POICTOU.
MARCHE
LIMOSIN.
Limoges
Sain
tonge
Angoumois
Perigort
Bourdeaux
GUIENNE.
GASCOGNE.
Bearn
Nauarre.
LANGUEDOC.
Toulouse
Castres
Carcassone
Narbonne
Perpignan
Montpelier
Nismes
Arles
PROVENCE
Orange
Avignon
DAUPHINE
Vienne
SAVOIE.
SUISSE.
Basle
Zuric
BOURGOGNE.
Dijon
Auxerre
Troyes
Langres
NIVERNOIS.
Neuers
Bourbonnois
LYONNOIS.
Lyon
Bresse
Clermont
AUVERGNE.
CEVENNES.
Viviers
Rovergue.
Rodes
QUERCI.
Cahors
Albret
Bayonne
Bell I.
Oleron I.
Ré I.
Rochelle
Medoc
Rhosne R
Loire R
Metz
Toul
Nanci
Verdun
Besançon
Brisac
Mombeliard
Alsace
Treues
Cologne
Coblentz
Bruxelles
Arras
Sedan
Reims
Chalons
Amiens
Paris
Roven
Caen
Havre
THE SPANISH NETHERLANDS
GERMANY
SPAINE.
THE MEDITERRANEAN SEA
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SAVOY
Lac de Geneue
SVISSE
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Ripaille
Thonon
CHABLAIS
GENEVOIS
VALLAIS
FAVSSIGNI
Cluse
Salanche
SAVOIE
Chambery
Mont Melian
Les Eschelles
Leagues
TARENTAIS E
Monstiers
PIE MONT
le Mont du St Bernard
la chambre
S Iean de Moriene
Lasnebourg
Grenoble
Isere R
DAVPH INE
Alpes
MORIENNE
IT ALIE


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GERMANY.
Carniola
Alpes
SVISSE
Grisons
Morla ques
Part of Turquie.
GOLFE DE VENISE.
Venise
Trieste
Aquilee
Milan
Cremone
Mantoue
Ferrara
Boloone
Ravenne
Rimini
Ancone
Parme
modene
Pise
Siene
Florence
Estate of the Church
TOS CANE
Rome
KING DOM OF NAPLES.
Naples
Salerne
Capri
Ischia
Manfredonia
Bari
Brindisi
Otrante
Tarante
Gallipoli
Ragusa
Budoa
Spalatra
Zara
Gorgona
Piombino
Elbe
The Toscane Sea
Corsica
Bastie
Boniface
SARDINIA
Oristan
Callari
MARE MEDITERRANEUM.
Isles de Lipara
Stromboli
Vulcano
Lipari
Palermo
Messine
Rhege
C d' Spartiuento
C. Colonna
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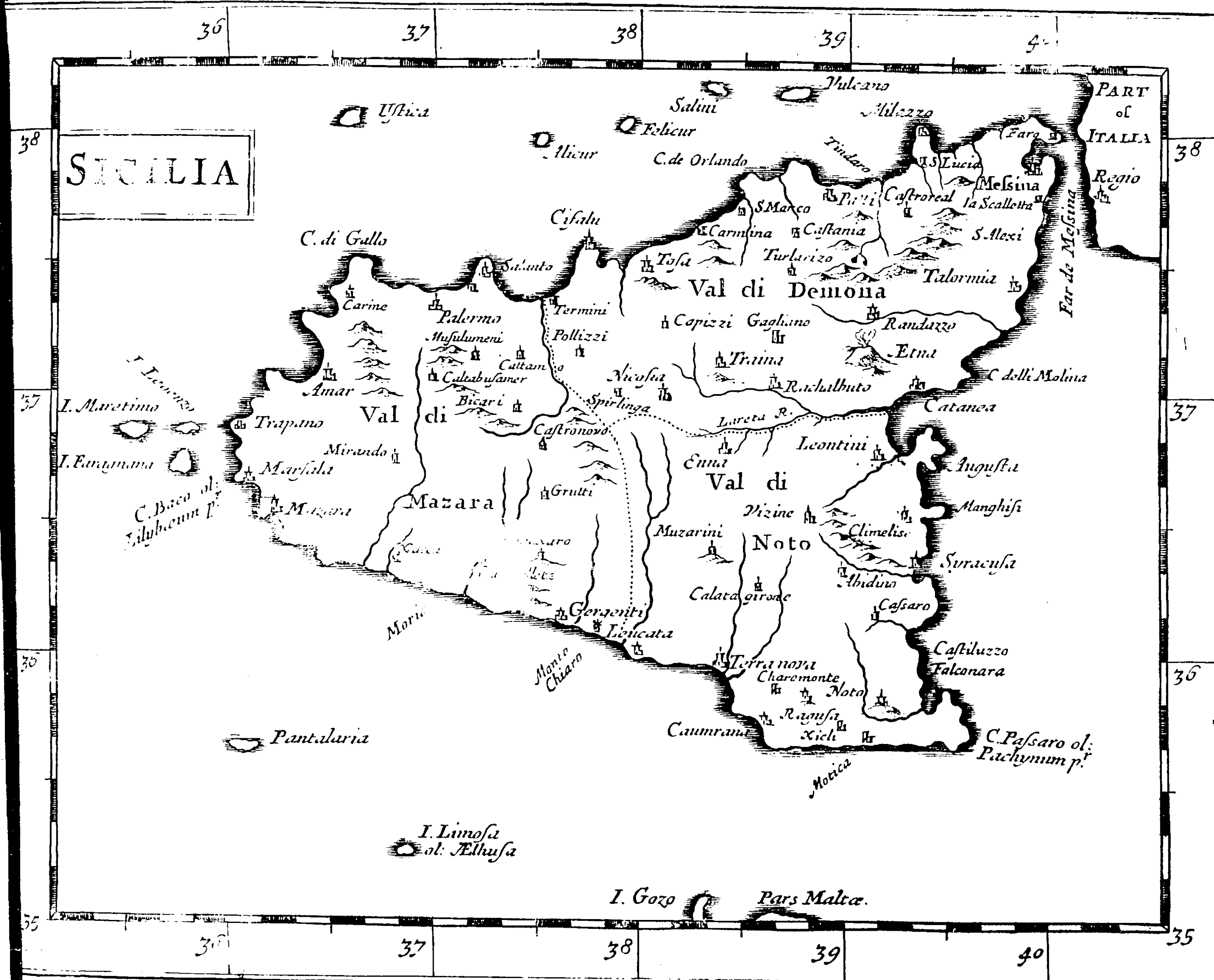
SICILIA
Ustica
Salini
Vulcano
Felicur
Alicur
Milazzo
PART of ITALIA
C. de Orlando
Tindaro
Faro
S. Lucia
Messina
Regio
S. Marco
Patti
Castroreal
la Scalletta
Cisalu
Carmina
Castania
S. Alexi
C. di Gallo
Tosa
Turlarizo
Salunto
Talormia
Val di Demona
Carine
Palermo
Termini
Capizzi
Gagliano
Randazzo
Far de Messina
Musulumeni
Pollizzi
Traina
Etna
Cattam
Calcabusamer
Nicosia
Radalbuto
C. dell' Molina
Amar
Bicari
Spirlinga
I. Maretimo
Trapano
Val di
Catanea
Lareta R.
Castronovo
I. Favignana
Mirando
Leontini
Marsala
Enna
Augusta
Val di
C. Baco ol: Lilybeum p.t
Mazara
Grutti
Mazara
Vizine
Manghisi
Muzarini
Noto
Climelise
Syracusa
Abidino
Calata girone
Cassaro
Gorgenti
Moria
Leucata
Castiluzzo
Monte Chiaro
Terra nova
Falconara
Charomonte
Noto
Ragusa
Caumrana
Xicli
C. Passaro ol: Pachynum p.t
Pantalaria
Motica
I. Limosa ol: Ælhusa
I. Gozo
Pars Maltæ.
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FLANDERS
or the Spanish
PROVINCES.
Leagues
HOLAN D.
ZE LAND
Flakee
Gaitemberg
Bos le Duc
Breda
Bergop zon
midelbourg
Flessingue
Lillo
Blankemberg
Ostende
Bruges
Sas de gand
Anuers
Antwerp
Herentals
Lire
Malines
Arscot
D. DE BRABANT
Eendouen
Venlo
Gueldre
Cleues
Graue
Ruremonde
Stephensuer
Maseick
Beringen
Diest
Louuain
Lewe
Hasselt
Mastrick
Tongres
S. Truyen
Tillemont
LIEGE
Liege
Indoigne
Gemblours
Bruxelles
Hall
Vilvorde
Aloste
Dendermonde
Rupelmond
Gand
Nieuport
Dixmude
FLAN DRE
Ipres
Bergue
Winox
Calais
Omer
Estres
Boulogne
Renti
Teroüane
Aire
Lillers
Bethune
S. Venant
la Bassée
Lille
Armentiers
Warneton
Meruille
Cassel
Mont
Menin
Oudenarde
Courtray
Tournay
Ligne
Ath
Enghien
Scheld R.
HAINAVT
Condé
S. Guislain
Binch
Mons
Charleroy
Namur
Meuse
Huy
Sambre R.
C. DE NAMVR
Bouuines
Dinant
Marche
Rochefort
Charlemont
Philippeuille
Mariembourg
Giuet
Chimay
Rocroy
Charleuille
Mezieres
Bouillon
Sedan
Donchery
Mouson
S. Hubert
Bastoigne
LVXEM BOVRG.
Neuchatel
Arlon
Luxembourg
Treues
Montmedi
Yuoy
Steney
Damuiller
Thionuille
Moselle R.
LORAINE.
Marauille
Sclessure
D. DE LA ROCHE
la Roche
Spa
Limbourg
LIMBOVRG.
Vesett
Juliers
la Chapelle
D. DE JULIERS
GER MA NIA.
Rhin R.
Vesel
Vlcurt
Valenciennes
S. Amand
Bauai
Le Quesnoy
Landrecy
Auesnes
Maubeuge
Bouchain
Cambrai
Creuecœur
Douai
Orchies
Lens
S. Pol
Hesdin
ARTOIS.
Arras
Scarp R.
Bapaumes
Pas
Dourlens
Abbeuille
Pont de Remi
Montreuil
Rue
Corbie
Bray
Perone
S. Quentin
Ham
Amiens
Somme R.
Picquigni
PICARDIE.
Roye
Montdidier
Noyon
la Fere
Guise
Oyse R.
la Capelle
CHAMPAGNE.
OCEAN
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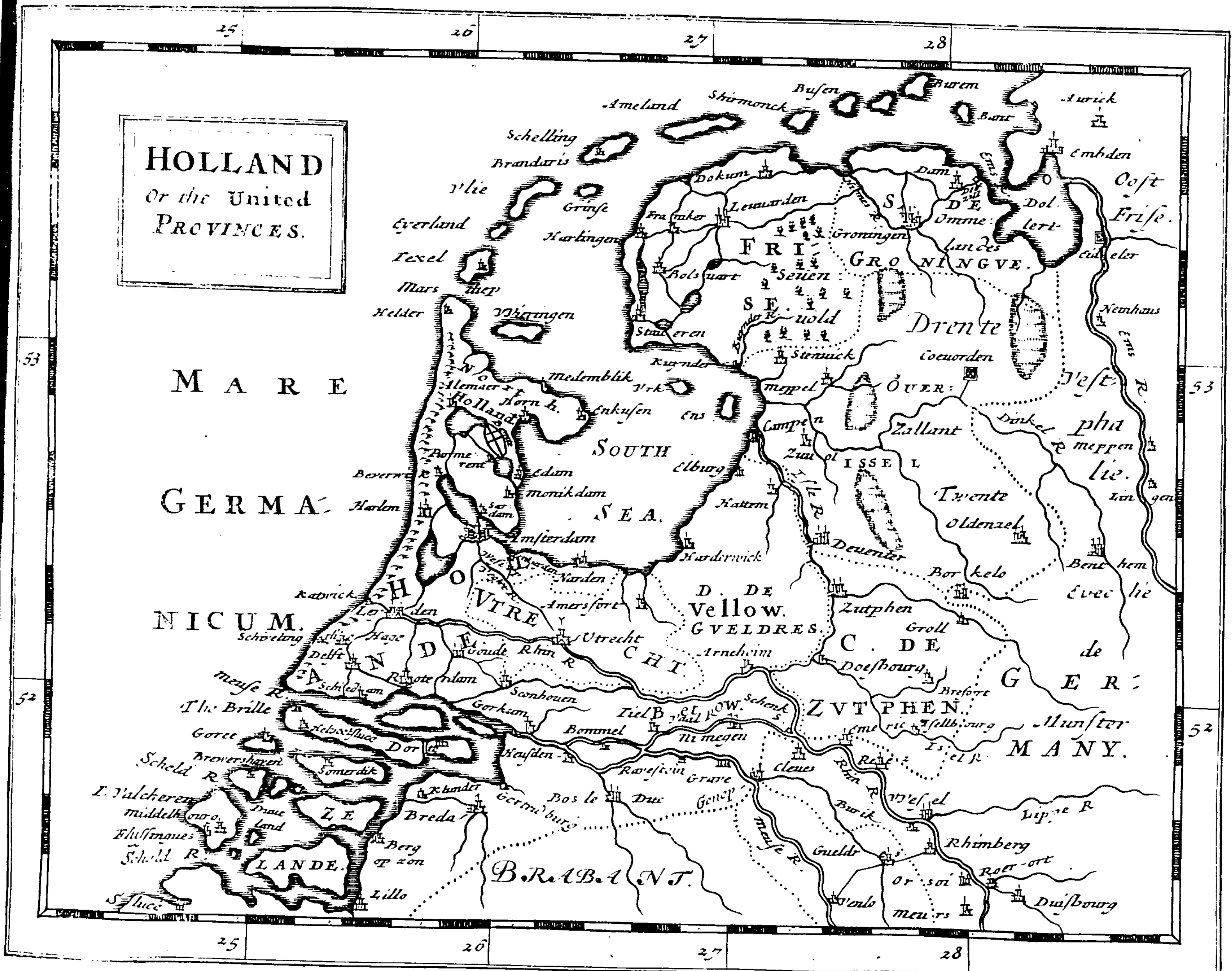
HOLLAND
Or the United
PROVINCES.
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MARE
GERMA
NICUM.
SOUTH
SEA.
Ameland
Schelling
Brandaris
Vlie
Grinse
Everland
Texel
Mars
Helder
Wieringen
Harlingen
Dokum
Leuuarden
Franker
Bolsuart
Stauveren
Kuynder
Stenwick
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Seuen
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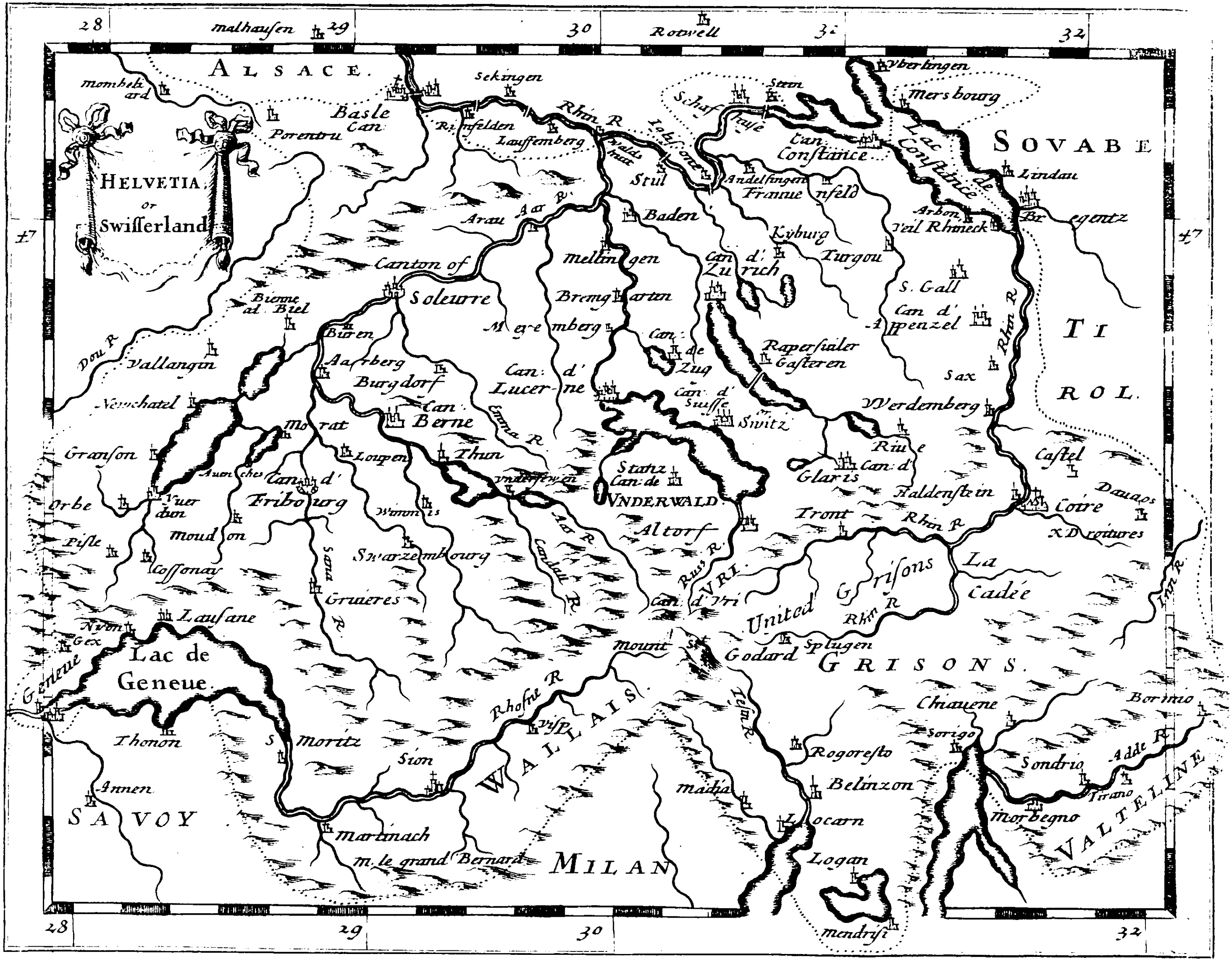
uold
Groningen
GRO NINGUE.
Dam
Ommelandes
Embden
Oost
Frise.
Dollert
Aurick
Burem
Busen
Drente
Coeuorden
Nevvhaus
Medemblik
Vrk
Ens
Enkusen
Horn
Alemaer
Holland
Purmerent
Edam
monikdam
Sardam
Harlem
Beverwick
Amsterdam
Narden
Amersfort
Harderwick
Hattem
Elburg
Campen
Zuuol
meppel
ISSEL
Zallant
Twente
Oldenzel
Deuenter
Borkelo
Benthem
Zutphen
Groll
Doesbourg
Bresort
ZUTPHEN.
Vellow.
GUELDRES
Arnheim
Katwick
Leyden
Hage
Delft
Schieland
Goude
Roterdam
Scoonhouen
Gorkum
Utrecht
VTRECHT
Rhin R
The Brille
Goree
Brewershaven
Somerdik
Dort
Heusden
Bommel
Tiel
Nimegen
Cleves
Raveston
Grave
Gennep
Bos le Duc
Breda
Gertruiburg
Berg op zon
Lillo
I. Valcheren
middelbourg
Flussingues
Scheld R
ZE
LANDE.
Sluce
BRABANT.
Venlo
Gueldr
Rhimberg
Orsoi
meurs
Duisbourg
Wesel
Lippe R
Munster
GERMANY.
Ems R
Westphalie
meppen
Lingen


GERMANY
MARE BALTICUM
MARE GERMANICUM
POLAND.
Prussia.
POMERANIA
MEKLEMBOURG
LOWER SAXONY
WESTPHALIA
UNITED PROVINCES
THE SPANISH NEITHERLANDS
Brunswick
UPPER SAXONY
BRANDEBOURG
LUSATIA
SILESIA
TURINGIA
MISNIA
HASSIA
FRANCONIA
BOHEMIA
MORAVIA
Palatinate
Haut Palatinat
LORRAINE
SVABIA
BAVARIA
AUSTRIA
STIRIA
Carinthia
Carniola
HONGRIA
Sclauonia
Croatia
ITALIE
TIROL
SVISSERLAND.
Grisons.
Franche Comte.
FRANCE.
Hambourg
Lubeck
Bremen
Embden
Berlin
Praque
Vienna
Munich
Ratisbone
Nuremberg
Cologne
Strasbourg
Dantzic
Breslau
Leipsick
Dresde
Erfort
Heidelberg
Metz
Salzbourg
Inspruck
Venise
Trente
Presbourg
Buda
Cracovie
Besancon
Basle
Zurich
Mare Baltic: I. Rugen
10. 20. 30. 40.
Leagues.



HELVETIA or Swisserland
ALSACE.
SOVABE
TIROL.
SAVOY
MILAN
WALLAIS
GRISONS.
United Grisons
VALTELINE
Lac de Geneue
Lac Constance
malhausen
Rotwell
mombeliard
Porentru
Basle Can
Sekingen
Rinfelden
Lauffemberg
Rhin R.
Schafhuse
Steen
Vberlingen
Mers bourg
Lindau
Bregentz
Arbon
Veil Rhineck
Can Constance
Andelfingen
Frauuenfeld
Stul
Baden
Arau
Aar R.
Canton of Soleurre
Bienne al Biel
Doux R.
Vallangin
Neuchatel
Buren
Aarberg
Burgdorf
Can Berne
Mellingen
Bremgarten
Megremberg
Can d' Lucerne
Can de Zug
Can d' Zurich
Kyburg
Turgou
S. Gall
Can d' Appenzel
Sax
Rapersuiler
Gasteren
Werdemberg
Can d' Suisse
Switz
Murat
Granson
Auenches
Can d' Fribourg
Loupen
Thun
Emma R.
Stanz Can de VNDERWALD
Glaris
Riue
Can d'
Haldenstein
Castel
Dauaos
Coire
Orbe
Yuerdun
Mouldon
Pisle
Cossonay
Wimmis
Swarzembourg
Sana R.
Gruieres
Altorf
Russ R.
VRI
Can d' Vri
Tront
La Cadée
Inn R.
Lausane
Nyon
Gex
Geneue
Thonon
Annen
S Moritz
Sion
Martinach
m. le grand Bernard
Rhosne R.
Visp
Mount St Godard
Splugen
Tesin R.
Rogoresto
Belinzon
Locarn
Logan
mendrisi
Madia
Chiauene
Sorigo
Bormio
Adde R.
Sondrio
Tirano
Morbegno
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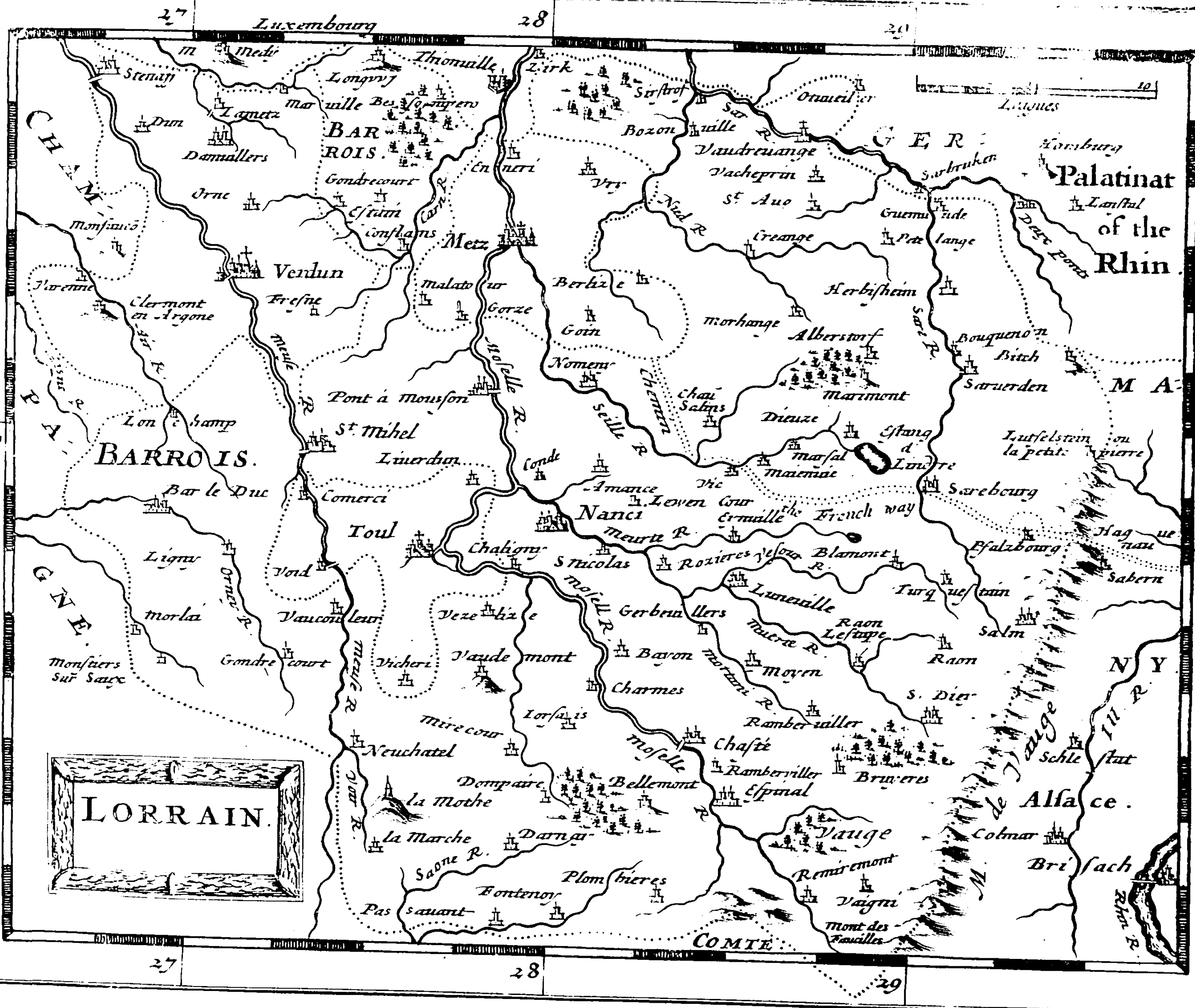
LORRAIN.
Luxembourg
27
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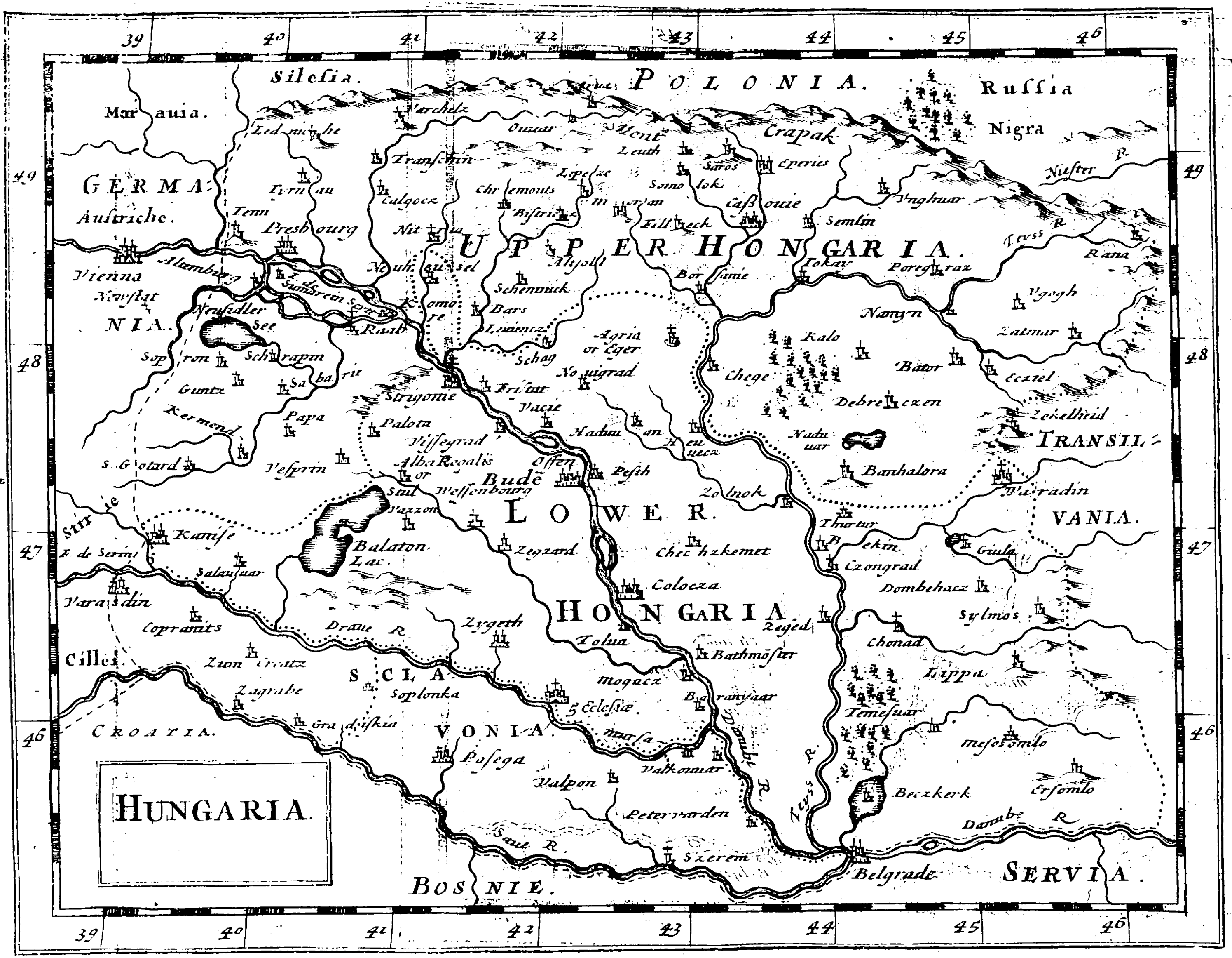
29
49
CHAMPAGNE.
BARROIS.
BARROIS.
GERMANY
Palatinat of the Rhin.
Alsace.
COMTE
Metz
Verdun
Nanci
Toul
Thionuille
Stenay
Longwy
Dun
Damuillers
Clermont en Argone
Pont a Mousson
St. Mihel
Bar le Duc
Comerci
Vaucouleur
Neuchatel
la Mothe
la Marche
Darnay
Fontenoy
Plombieres
Remiremont
Espinal
Chasté
Ramberviller
Bruyeres
Charmes
Bayon
Moyen
Luneuille
Blamont
S. Nicolas
Chaligny
Vezelize
Vaudemont
Mirecour
Dompaire
Bellemont
Marsal
Vic
Dieuze
Marimont
Albersdorf
Morhange
Sarebourg
Pfalzbourg
Saruerden
Bitch
Bouquenon
Sarbruken
Vaudreuange
Deux ponts
Homburg
Lutselstein ou la petite pierre
Haguenau
Sabern
Salm
Raon
Raon Lestape
S. Diey
Schlestat
Colmar
Brisach
Moselle R.
Meuse R.
Sare R.
Ill R.
Rhin R.
Saone R.
Seille R.
Meurte R.
Nied R.
Estang de Lindre
Conde
Amance
Gorze
Goin
Nomeny
Malatour
Fresne
Gondrecourt
Estain
Conflans
Orne
Morlay
Ligny
Monstiers sur Saux
Mont des Fauilles
Vaugé
Vaigni
Pas sauant
the French way


HUNGARIA
POLONIA.
Silesia.
Russia
Nigra
Crapak
Marauia.
GERMA
Austriche.
NIA.
Vienna
Newstat
Presbourg
UPPER HONGARIA.
LOWER
HONGARIA
TRANSIL
VANIA.
SCLA
VONIA.
CROATIA.
BOSNIE.
SERVIA.
Belgrade
Bude
Offen
Pesth
Strigonie
Alba Regalis or Wessenbourg
Balaton Lac
Agria or Eger
Tokay
Debreczen
Temesuar
Colocza
Zegzard
Zeged
Eperies
Cassouie
Raab
Komore
Neusidler See
Kanise
Varasdin
Cilles
Zagrabe
Posega
Szerem
Peterwarden
Drave R.
Saue R.
Danube R.
Teyss R.
Niester R.
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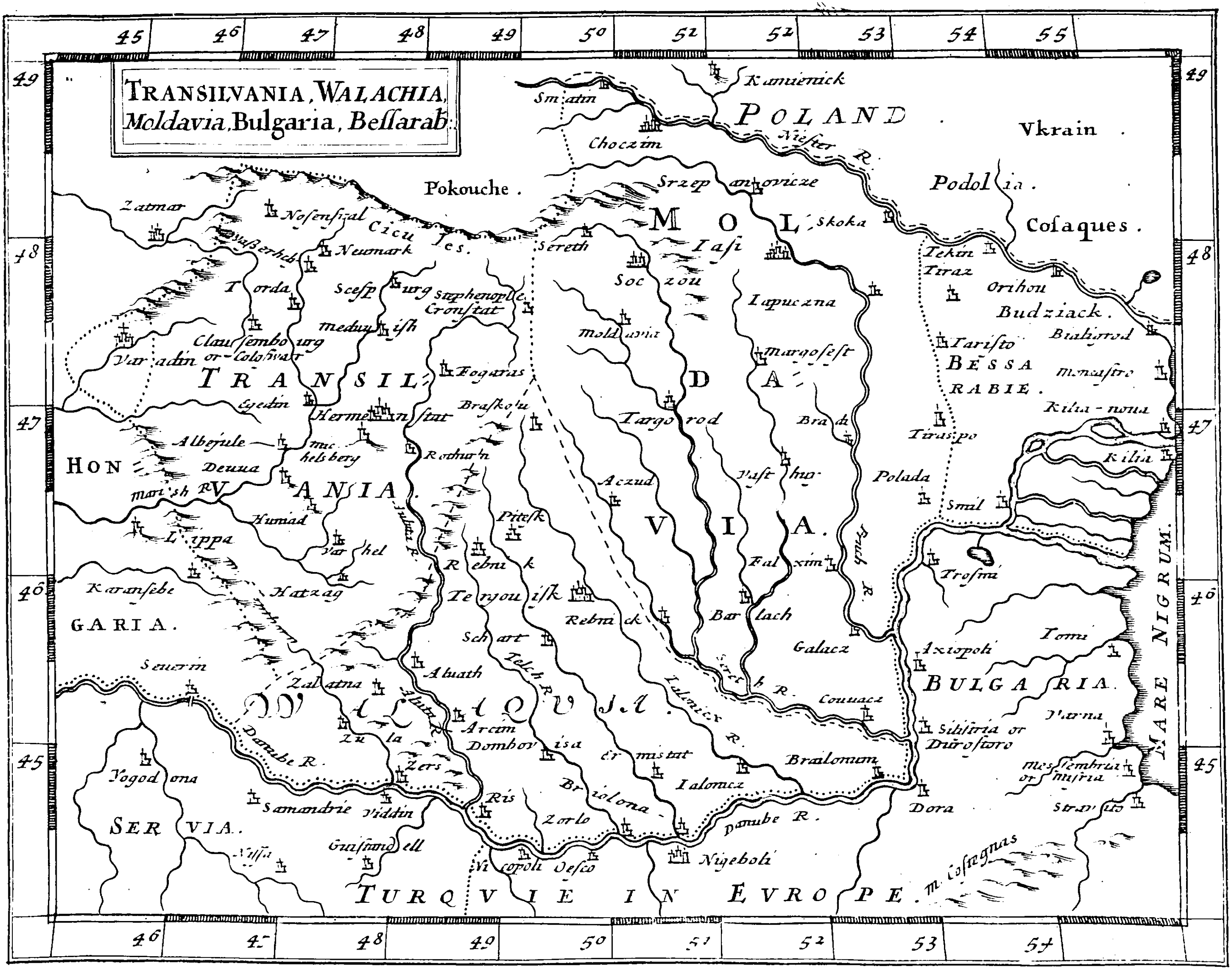

TRANSILVANIA, WALACHIA, Moldavia, Bulgaria, Bessarab
POLAND
Vkrain
Podolia
Cosaques
Pokouche
MOLDAVIA
TRANSILVANIA
HONGARIA
BESSARABIE
Budziack
BULGARIA
WALAQUIA
SERVIA
TURQUIE IN EVROPE
MARE NIGRUM
Kamienick
Smiatin
Choczim
Niester R.
Srzepanowicze
Skoka
Iasi
Soczou
Iapuczna
Moldavia
Margosest
Targorod
Brad
Vasthny
Aczud
Falxim
Barlach
Galacz
Poladu
Tekin
Tiraz
Orihou
Taristo
Bialigrod
Monastro
Kilia-noua
Kilia
Tiraspo
Smil
Trosma
Axiopoli
Tomi
Varna
Silistria or Durostoro
Mesembria or Misria
Dora
Zatmar
Nosenstal
Cicules
Sereth
Neumark
Bisterich
Torda
Scesp
Burg
Stephenople
Cronstat
Meduyish
Clausembourg or Colosvuar
Varadin
Fogaras
Egedin
Hermenstat
Braskou
Albejule
Michelsberg
Rothurn
Deuua
marish R
Humiad
Lippa
Varhel
Pitesk
Rebnik
Karansebe
Hatzag
Teryouisk
Rebnick
Schart
Abuath
Telch R
Ialomicz R.
Seret R.
Prut R.
Couuacz
Seuerin
Zalatna
Aluta R.
Arcim
Dombovisa
Ermistat
Bralonum
Danube R.
Zula
Zers
Ris
Briolona
Ialomcz
Zorlo
Vogodona
Samandrie
Viddin
Guisindell
Nissa
Vicopoli
Oesco
Nigeboli
Strauiso
m. Costegnas
45 46 47 48 49 50 52 52 53 54 55
46 47 48 49 50 51 52 53 54


TURQVIE
in Europe
HONGRIA
Transilvania
Moldavia
BULGARIA
MARE NIGRUM
WALAQVIA
SCLAVONIA
CROATIA
GERMANIA
BOSNIA
SERVIA
DALMATIA
Golfe of Venise
ITALIE
MACEDONIA
ROMANIA
Mer de Marmara
ALBANIA
EPIROS
THESSALIE
GREECE
ACHAYE
MOREA
ARCHIPELAGO
Anatolia
Calabria
Sicile I.
Belgrade
Constantinople
Andrinople
Philippopoli
Salonaki
Larissa
Lepanto
Patras
Corinte
Napoli
Corfu
Cefalonie
I. Zante
Stalimene
Negrepont
Cerigo
Milo
Paro
Stampalia
Tenedo
Ragusa
Spalatro
Zara
Ancone
Naples
Bari
Brindisi
Taranto
Otranto
Messina
Rhegio
Durazo
la Valone
Pella
Edessa
Scutari
Sofie
Nissa
Varne
Silistra
Nigeboli
Modon
Coron
C. Matapan
Scio
Metelin
Andri
Teno
Samo
Nicaria
Morgo
Troye
Gallipoli
Dardanelle
Adrinople
Novabazar
Uschub
Ancone
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DANEMARK
Viz.t
IUTLAND, ZELAND,
Slefwick, Holftein.
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Schaw
Pointe
Bahus
mal
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GOTIE.
Gotenbourg
Elsbourg
Consbac
Falk sem
borg
Helmstad
Lahohn
Engel
holm
Elsim
bourg
Landscron
Lunden
malmoyen
SCHONEN
MARE
Scau
Binsles
Iiring
Vensissel
Seebr
IVT
LAND
Lesouw
Tysted
Alborg
Nicoping
Maria
ker
Wiborg
Hobro
Lemwick
Holstbro
Rinko
ping
Randersen
Arhusen
Ebeltod
Horsens
Ward
Weel
Hennebor
Kolding
Ripen
Haders
Tonderen
Apenrad
Alsen
Sanfoe
Endelo
The Belt
Anout
The Sund
Fredrichbourg
Elseneur
ZELANDE
Roskilt
Coppenhagen
Holbeck
Sora
Kingsted
Koge
Cors
Prestoe
Wes
Warding
borg
FIONIE
Otten
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Niborg
Asçens
Foburg
Arro
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Laland I.
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Vicop
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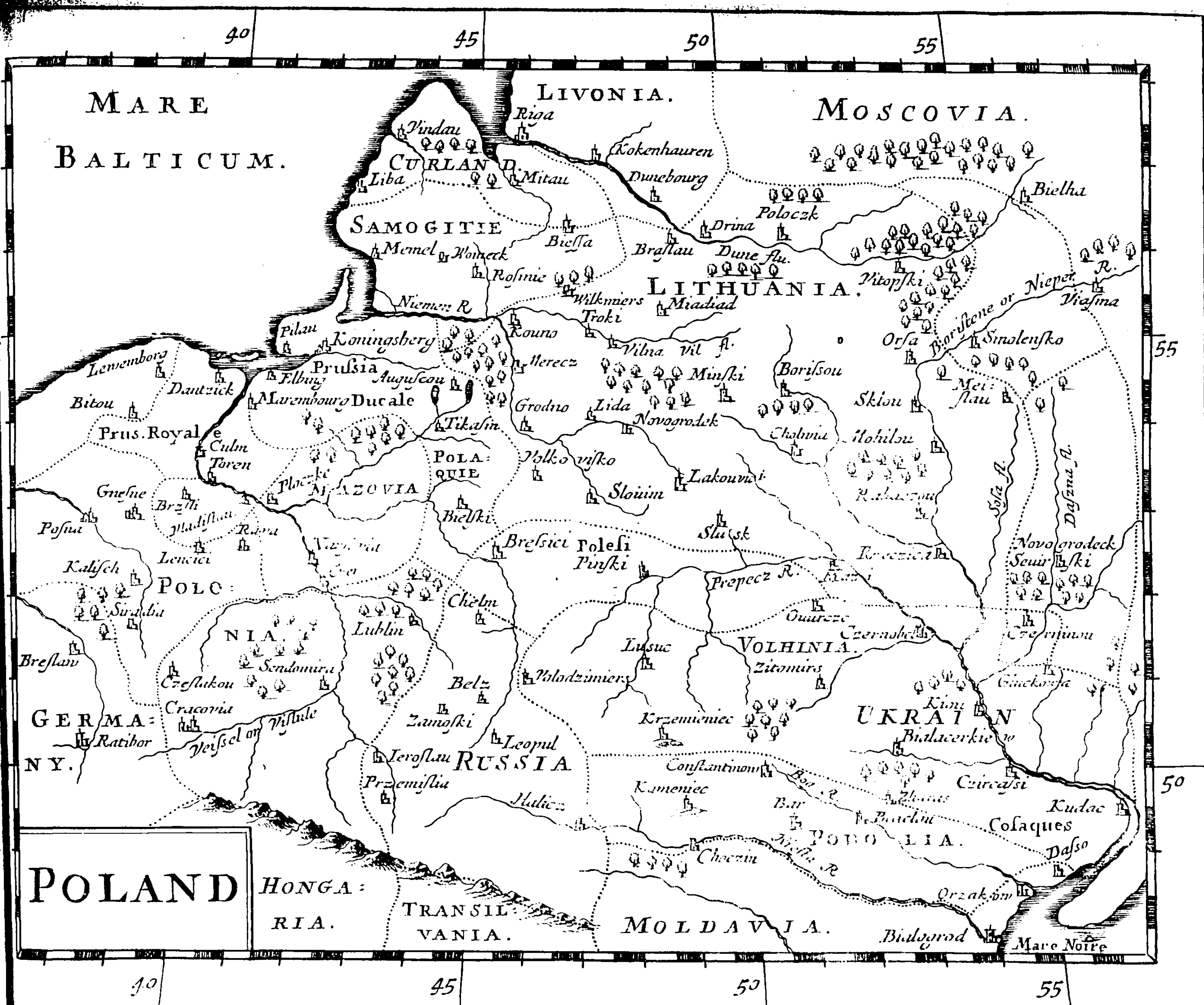
Falster I.
I.
Mone
Stekoe
GER
MANI
CUM
SLESWICK.
Husum
Flensbourg
Tonningen
Gottorp
Slesuick
THE BALTIQVE.
Frederic
stad
Ekelenfort
Christian
preis
Borg
Femeren I.
SEA.
Lunden
Heyde
meldorp
Rensbourg
Kiel
Lutkenbourg
Oldeborg
Dit
mars.
Itzeho
Niemunster
Ploen
Niestad
Segeberg
Wilster
Krempe
Holstein.
Glukstad
Oldeslo
Lubeck
Pinnemberg
Wedell
Elbe
Hamborg
GER
MANIA

MOSCOVIA
OCEAN. SEPTENTRION ALIS.
Kola
Lappons Moscouites.
Kandalax
Mare Album
Kolgoi
C. Candenos
St. of Weigatz
Samoiedes
Obdore.
Loppie.
Petzore.
Condora.
monts Riphees
Siberie.
Tobolsko
Locomorie.
S. Michel Arcangel
S. Nicolas
Colmogorod
Duina
Soma
Lac Onega
Lac Ladoga
Kargapol
Oustioug
Perm
Kama
Permie.
GREAT TARTARIE.
SVEDE.
the Baltick Sea
Finlande.
Wiborg
Ingrie.
Narva
Reuel
Curlande.
Livonie.
Riga
Plescow
Stara Russa
Biolozero
the Great Nowgorode
Bologda
Volsk
Lesser Nowogrod
Czeremisses Logounoy.
Vachines.
Casan
Nagaia horda.
Volga R.
Yeroslau
Susdal
Rostou
Murom
Volodimer
Vasiligorod
Czeremisses Nagornoi.
Bulgar
Zauolha horda.
Samara
Soratto
Calmouques.
Castrimo gorod
Rezan.
Moscou
Colna
Tver
Rzova
Bulha
Dune R.
Lithuanie.
Vilne
Smolensko
Mosaiski
Nieper or Borysthene R
POLONIA.
Vorotin
Croom
Donkagorod
Merduate.
Donic or Tanais R.
Nouogrodeck
Czernihou
Desert of Borissagorod
Rosdori Donski.
LESSER TARTARIE.
Kiou
Vkrane.
Cosaques.
Azof or Azac
Nagaiski.
Circasses.
Astracan
mare Caspium


POLAND
MARE BALTICUM.
LIVONIA.
MOSCOVIA.
CURLAND.
SAMOGITIE
LITHUANIA.
Prussia Ducale
Prus. Royal
MAZOVIA
POLAQUIE
POLONIA.
GERMANY.
HONGARIA.
TRANSILVANIA.
MOLDAVIA.
RUSSIA
VOLHINIA.
UKRAIN
PODOLIA.
Polesi
Cosaques
Riga
Vindau
Liba
Mitau
Kokenhauren
Dunebourg
Memel
Rosinie
Biessa
Braslau
Drina
Poloczk
Dune flu.
Vitopski
Bielha
Viasma
Borystene or Nieper R.
Niemen R.
Pilau
Koningsberg
Kouno
Troki
Wilkmiers
Miadiad
Vilna
Vil fl.
Orsa
Smolensko
Lewenborg
Dantzick
Bitou
Elbing
Marembourg
Auguscou
Grodno
Lida
Minski
Borissou
Sklou
Novogrodek
Tikasin
Culm
Toren
Gnesne
Posna
Kalisch
Siradia
Leneici
Rava
Lakouvic
Slouim
Slusk
Bielski
Bresla
Pinski
Prepecz R.
Chelm
Lublin
Sendomira
Breslaw
Creslakou
Cracovia
Ratibor
Weissel or Vistule
Belz
Zamoski
Leopul
Jeroslau
Premislia
Halicz
Volodzimiers
Lusuc
Zitomirs
Krzemieniec
Constantinow
Kamieniec
Bar
Chaczin
Kiou
Bialacerkie
Czircassi
Kudac
Dasso
Orzakow
Bialogrod
Mare Noire
Sosa fl.
Dazna fl.
Novogrodeck
Seuirski
Czernobel
Mohilou
Bog R.
Niester R.
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EUROPE
OCEANUS SEPTENTRIONALIS
OCEANUS OCCIDENTALIS
The First Meridian
The Polar Circle
Islandia
m Hecla
Fero
Shetland
Orcades
Hebudes
Scotia
Anglia
Hibernia
London
Canall
Flandre
Paris
Loire R
FRANCE
Bourdeaux
Lion
Toulouse
Marseille
Galice
ESPAGNE
Madrid
Tolede
Barcelon
Lisbone
Tage R
Sevill
Straits of
Gibraltar
Tanger
Sale
Fez
Oran
Alger
Biserte
Tunis
Souse
BARBARIE.
AFRIQUE
Tripoli
Caruena
Alexandria
MARE
MEDITERRANEUM.
Corsica
Sardaigne
Minorque
Maiorque
Yuica
Sicile
Palermo
Naples
Napoli
Rome
ITALIE
Genes
Milan
Venise
Maltha
Candie
Archipelago
Rhodes
Cyprus
Alep
Ierusalem
Anatolie
Smirna
Efesus
Cogni
Amasie
Tre bisonde
Bursse
Fogie
Greece
morea
la Valone
TURQUIE
Andrinople
Constantinople
Belgrade
Bude
Vienna
Hongarie
Transilvania
Moldavia
Valaquia
Vkraine
POLONIA
Lituania
Cracovie
Varsovie
Danzik
GERMANY
Bohemie
Brandenb
Cologne
Hambourg
Stetin
Holland
Amsterdam
Lorraine
Fr. Cote
Suisse
Savoie
Dania
Copenhagen
Gotia
Stokolme
Mare Balticum
SUEDE
Finland
Abo
Wiburg
Sinus Botnicus
Bergen
Lapland
Wardhus
Kola
Nort Cape
Lapland mos.
Mare Alb
S. Nicolas
Arcangel
Duina R
Oustioug
Russia
Volga R
Less Novogrode
Novogrode
Volodimere
Moskou
Smolensko
MOSCOVIE
Lesser Tartarie
Tartarie
Casan
Astracan
Mare Caspium
MARE NIGRUM
Caffa
Georgia
ASIA
Eufrate R
Samoiedes
Tingoeses
Condora
Siberia
Obi R
Livonia
Riga
Curlande
Dune R
Sound
H. Mol sculp. Londini.


ENGLAND, SCOTLAND; &IRELAND. With the ILES. Thereto Belonging.
Leagues
10 20 30 40 50 60
Fero Iles.
Schetland or Hitland.
Orcades
Lewys.
Skye.
Hebrides Ins: qu ac Hebudes quas Beda Meuanias Vocat.
S Kilda
Mula
Illa.
SCOT LAND.
Edenburg
Glasgus
Sterling
NOR WAY.
Bergen.
Tellemarck
THE NORTH SEA. or GERMAN OCEAN.
DAN MARK
The Irish Sea.
IRE LAND.
Con
Lemster.
Dublin
Mounster
Man
Anglesey
YORKE SHIRE.
ENG LAND.
Chester
WAL LES.
London
Bristol
Salesbury
Dorchester
Rochester
The Landes End
Wicht
THE BRITISH SEA or CHANELL.
Garnsey
Iarsey
Hollandia.
Zeelandia
UNITED PROVINCES.
SPANISH PROVINCES.
Flandria.
PICARDIA.
NORMANDIE
BRETAIGNE.
FRANCE.
10 15 20 25 30
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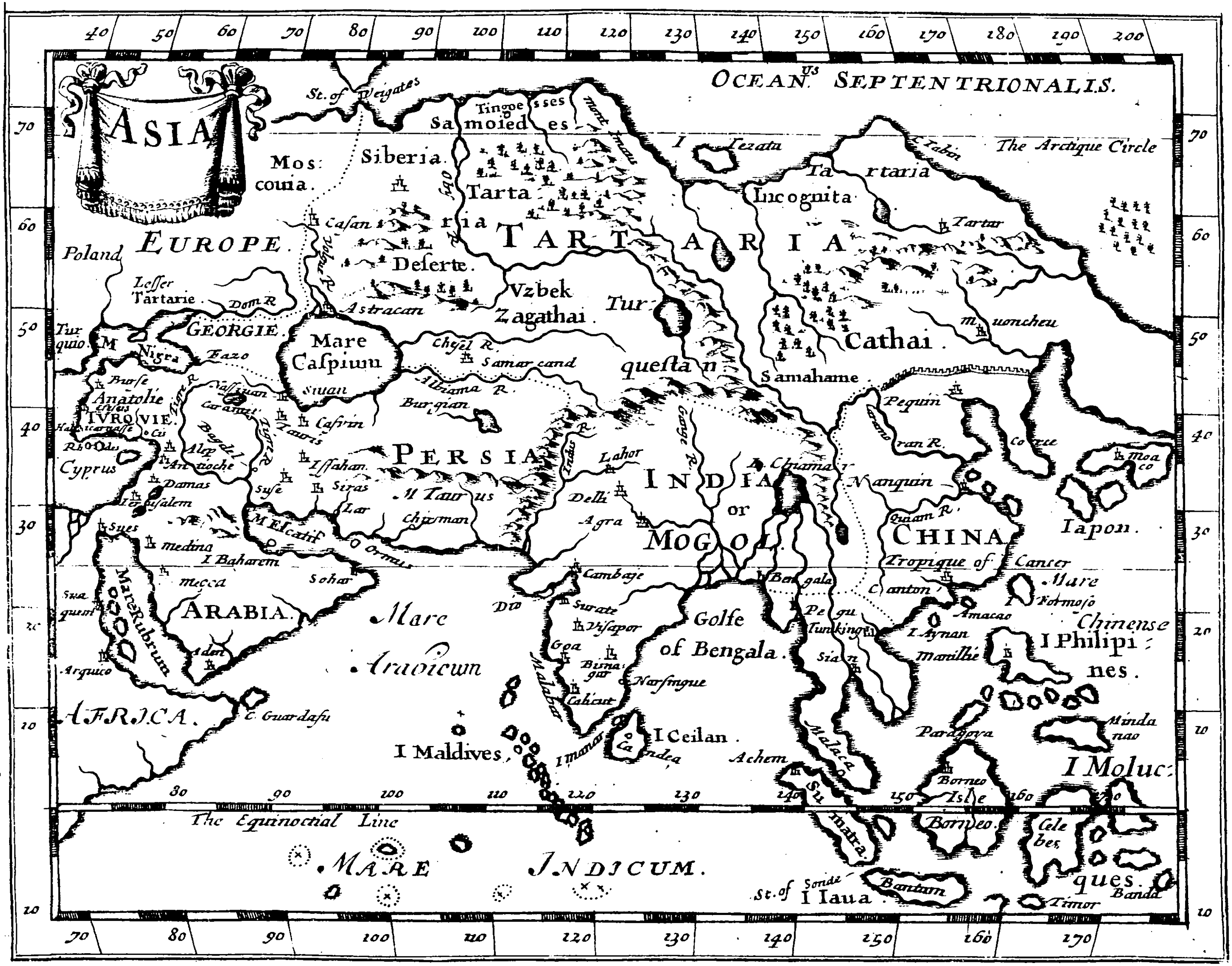
ENGLAND
S C O T L A N D.
THE IRISH SEA.
THE ENGELISH CANNIL.
Barwick
Selkirck
Dunfreis
Annan
NORT HUMBER LAND
CUMBER LAND
WEST MORLAND
YORKE SHIRE
LANCAS SHIRE
LIN COLNE SHIRE
Yorke
Hull
Scarborough
Flamborough Head
Spurn Head
Lincolne
Boston
Burnham
Cromere
NOR FOLK
Norwich
SUF FOLK
Ipswic
ES SEX
London
KENT
Dover
SUR REY
SUS SEX
HANT SHIRE
WILT SHIRE
SOMER SET SHIRE
DORS ET SHIRE
DE VON SHIRE
CORN WAL
Excester
Plymouth
I. Wight
Portland
Lizard
Bristoll
Oxford
Glocester
Shrop Shire
Montgomery
Monmouth
Breknok
Hereford
Lichfeild
Chester
Nottingham
Leicester
Northampton
Warwick
Worcester
Cambridge
I. Man
Dublin
Strangford
Milford Haven
S. Davids
Cardigan
Carnarvon
14 15 16 17 18 19 20 21 22
56 55 54 53 52 51


SCOTLAND
Orcades
Stroma
Caithnes
Dunbeth
Ross
Skey I.
Edenburgh
Dunbar
Dunglas
Barwick
Belford
Billingham
Newcastle
Carlile
Brampton
Longtown
Tiuedale
Selkirck
Galasheele
Pebils
Biggar
Lauder
Perth
Dunkeld
St Andrews
Aberdeen
New Aberdeen
Cullen
Orkney
Loch
Quaber
Lorne
Arren
Zochna
Kirkcudbright


IRELAND
THE IRISH SEA
Scotland
England
CONNAUGHT
LEINSTER PROVINCE
MUNSTER PROVINCE
LONDONDERRY
ANTRIM COUNTY
DOWN COUNTY
TIRONE
ROSCOMMON COUNTY
LONGFORD
KINGS
KILKENNY
WEXFORD
TIPPERARY
CLARE COUNTY
Limrick County
CORKE COUNTY
Waterford
Dublin
Wexford
Limrick
Corke
Tory I.
Rathlin
C. Clear
Mullet
Achill
Shanon
St Davids
Magee I.
Lough Neagh
Sligo
Galloway
Kilkenny
Cashel
Clonmel
Youghill
Athlone
Drogheda
Belfast
Colerane
Ardmagh


ASIA
OCEANUS SEPTENTRIONALIS.
The Arctique Circle
St. of Weigates
Samoiedes
Tingoesses
I Iezata
Mos couia.
Siberia.
Tarta ria
TARTARIA
Tartaria Incognita
Tartar
EUROPE.
Poland
Casan
Deserte.
Lesser Tartarie
Dom R.
Astracan
Vzbek Zagathai.
Turquestan
Cathai.
Samahame
GEORGIE.
Mare Caspium
Siuan
M Nigra
Samarcand
Turquio
Anatolie
TVRQVIE.
Burse
Cyprus
Rhodes
Persia
Tauris
Casbin
Burgian
Issahan.
Siras
Lar
Susa
M Taurus
Chirman
Damas
Ierusalem
Alep
Antioche
Sues
medina
mecca
I Baharem
M El catif
Ormus
Sohar
ARABIA.
Aden
Mare Rubrum
Arquico
Suaquem
AFRICA.
C. Guardafu
Mare Arabicum
Dio
Lahor
Delli
Agra
INDIA or MOGOL.
Chiamay
Cambaye
Surate
Visapor
Goa
Bisnagar
Narsingue
Calicut
Malabar
Golfe of Bengala.
Bengala
Pegu
Tunking
Sian
I Ceilan.
Candea
I Maldives.
Achem
Malaca
Sumatra
Pequin
Nanquin
Corree
CHINA.
Tropique of Cancer
Canton
Amacao
I Aynan
Iapon.
Mare Chinense
I Formoso
I Philipines.
Manilhe
Paragoya
Mindanao
Borneo
Borneo Isle
I Molucques.
Celebes
Banda
Timor
Bantam
I Iaua.
St. of Sonde
The Equinoctial Line
MARE INDICUM.
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
70 60 50 40 30 20 10
70 80 90 100 110 120 130 140 150 160 170

TURQUIE
in Asia
MARE NIGRUM or
PONT. EVXINUS
GEORGIA.
MARE CASPIUM.
ANATOLIA
TURCOMANIA
ARMENIA.
ROMANIA.
Archipelago
Aladuli.
Caramanie
G. de Sattalie.
I. Cyprus
MARE MEDITERRANEUM.
SYRIA.
DIARBEK or MESOPOTAMIA.
PERSIA.
ARABIA DESERTA.
Caldar.
EGYPTE.
ARABIA PETREA.
Mare Rubrum
MARE EL CATIF.
Constantinople
Alexandrie
Aleppo
Antioche
Damas
Jerusalem
Bagdaht
Babilon
Trebisonde
Tripoli
Smirne
Rhodes
Tabris
Erzerum
M. Ararat
Derbent
Mosul
Nisibin
Balsera
Gran caire
Terre Sainte.


MARE MEDITERRANEUM
TVRQVIE
Isfahan
Arabia Deserta
Arabia Petrea
PERSIA
MARE EL CATIF
Bedouins
ARABIA FOELIX
MARE ARABICUM
ARABIA
Sues
Lar
Sohar
Aden
Zeila
Barbora


PERSIA
MARE CASPIUM.
ZAGATHAI
TURQUIE
SERVAN
KILAN
Curdes
ADIRBEITZAN
MESANDERAN
TABRUSTAN
CHORASAN
SABLUSTAN
INDIA
ERAK
FARS
CHUSISTAN
KIRMAN
SITZESTAN
MEKERAN
Mont Taurus
Desert de Minsi
MARE EL CATIF
ARABIA
THE INDIAN OCEAN.
the Straits of Mocandan
Derbent
Scamachi
Baku
Tabris
Ardebil
Karabach
Casuin
Soltanie
Hemadan
Kaschan
Isfaham
Iescht
Arbele
Bagdaht
Susa
Kom
Ferabat
Amul
Nisabur
Thous
Gergian
Merue
Balch
Badakschian
Herat
Mesat
Sus
Caph
Nisabul
Candahar
Ormus
Iasques
Tankabanka
Dulainda
Guadel
Makran
Sind
Sistan
Cherman
Moghestan
Gombru
Bander abassi
Lar
Stras
I Baharem
El Catif
Oxus
80
90
100
110
40
30


EAST
INDIA
TARTARIE
Balk
INDIA
AGRA
DECAN
CHINA
THE BAY
OF
BENGALL
ICEILAN
Thibet
or
Thobrot
Turques
tan
M. de Caucase
Kordwaare
Cabull
Indus R.
Kachemire
Sirinake
Attok
Multan
Lahor
Siba
Serenagar
Bullo
ques
Suckar
Coul R.
Hendowane
Delli
Bando
Iesebmere
Tatta
Asmere
Gualeor
Benares
Amadabat
Cambaie
Surate
Golfe
Cambaia
Diu
Goa
Bisnagar
Maderas or
Fort St George
S. Thome
Trankebar
Cochin
Cap de Comorin
Colombo
Galle
Punte de Galle
Candea
I. Mal
dives
Bengala
Pegu
Arracan
Chergaon
Pitan
Gor
Ava
120
130
140
40
30
20
10


TARTARIA.
The Northern OCEAN.
MOSCOVIA
Siberie
Locomorie
TARTARIA DESERTA
Samaie des
Loppi
Tingoeses
L. Tezata
Tabin prom
Bargu
Cataiora
Lac Coras
Tator
Mongul
Tenduc
Cauona
TARTARIA ANTIQUA
Desert Belgian
Bulgar
Casan
Zauolska Horda
Cosaski Horda
Nagai
Kalmouques
Kithaisko
Cambalich
Lac Kithay
TURQUESTAN.
Astracan
Vzbek
ZAGATHAI
Samarcand
Bochara
Thibet or Tobrot
Kesel R
Albiamu R.
Cascar
Camul
Turfon
Campion
Cambalu
Tanguth
Desert de Lop
Lop
CATHAI
Yugui
Paguin
MARE DE KILAN
PERSIA.
INDIA.
CHINA.
Volga R.
Ob
Ob R.
Sacmo
Succuir
Erzimul
Tingui
Sindu
Ciandu
Caschio
Nuchu
Tangu
Samaha me
Diuasi
Cossacy
Maraiue
Zahaspe
Sachiene
90
100
110
120
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140
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170
180
190
200
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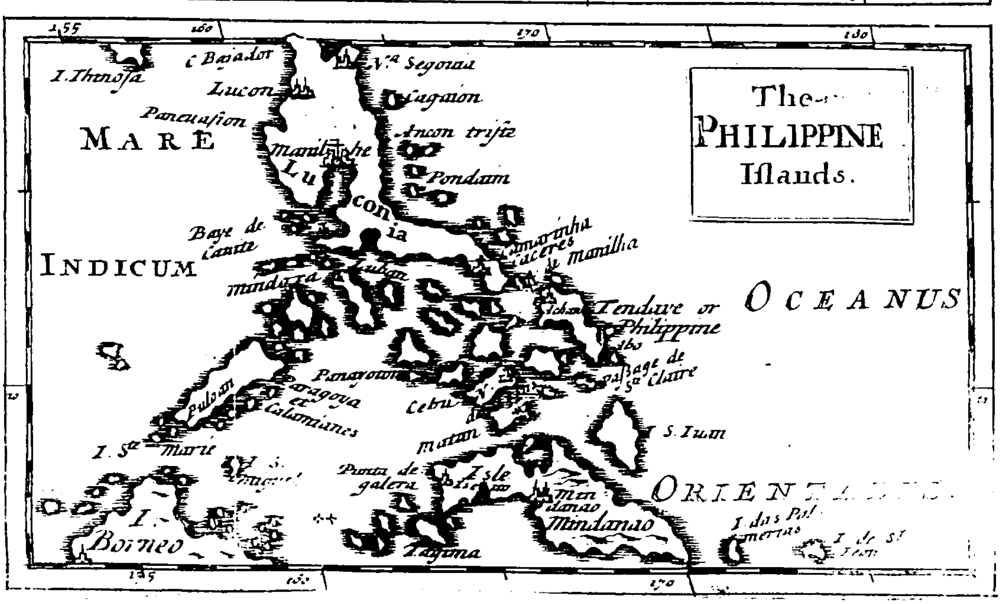
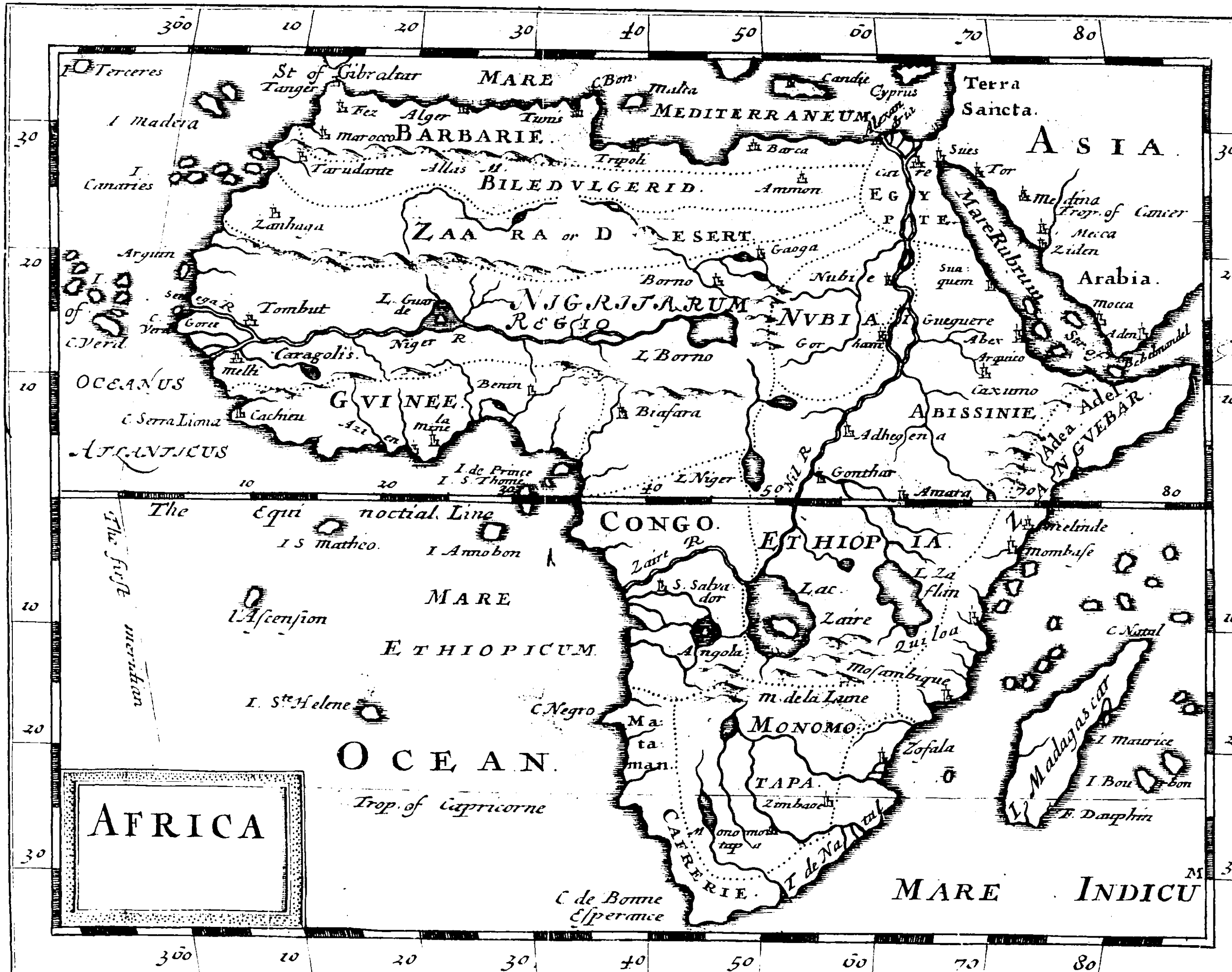
CHINA.
TARTARIA.
Gathai
Tanyn
Samahanie
Desert de Xamo
Niulham
Charchir
Yupi
PEQVIN
Pequin
Xiansieu
Scamsi
Ochian
Pauting
SCIANSI
Fun
Chuanchen
Chaifun
XENSI
Cancer
Singan
Caramoran R.
XANTVNG
Xantung
LEAOTVNG
Leaotung
Sur
Corea
Corei
Golfo of Nanqim
HONAN
Honan
Caifurm
NANQVIN
Nanquin
Iquelparts
Iapon
INDIA
Timo
coues
Gueves
cico
cangue
HVQVAM
Wchang
Nan
caam
KIAMSI
CHEQVIAM
Seamhay
Hamcheu
Lequeo
QVICHEV
Sinan
Chingtu
SV SCVEM
Vanam
Fucheu
FVQVIEM
Chincheo
Lampo
les Roys mages
I. Formose
or Pakim
Zelande
Lanka
Zac
chiau
hay
Laues
Yansiquam R.
QVANSI
Quanci
Quelin
Chaokin
YVNNAM
Yunnam
CANTON
Canton
Macao
MARE
CHINENSE
I. Aynam
G. of Co
chinchina
Tunquin
40
30
20
160
170


SIAM.
MALACCA
and the Indian
ISLANDS.
KINGDOM OF CHINA.
KINGDOM OF TUNQVIN
The Bay of Tonquin
BAY OF BENGALE.
SIAM
COCHINCHINA
Cambodia
Golfe of Siam
Pulo Condor
MALACCA
Str. of Malacca
Borneo
Linea Equinoctialis
Oceanus Orientalis
Mare sive Indicum.
Christmas Isle
Engano I
I. Nassau
Goede fortuin
I. Calaspes
Pegu
Bengala
Aracan
Martaban
Odiaa Siam
Bantam
Bintang
Singapura
Andemaon
Nicubar
Dos Sombreros
Achem
Canal St George
St. of Sunda
Zanciaro
Malano
Tanjampura
Sussadana
Banjarmassin
Tuban
Japara
Mataram
Balij
Bima
Macara
Paman
Carol
Pulo Ubi
Champaa
Pahang
Patane
Queda
Ligor
Malacca
Jambi
Palimban
Menancabo
Indrapura
Priaman
Pedro
Pacem
Aru
Batham
Banca
Anamba
Pedra
Matuma
Marudo
Bogu

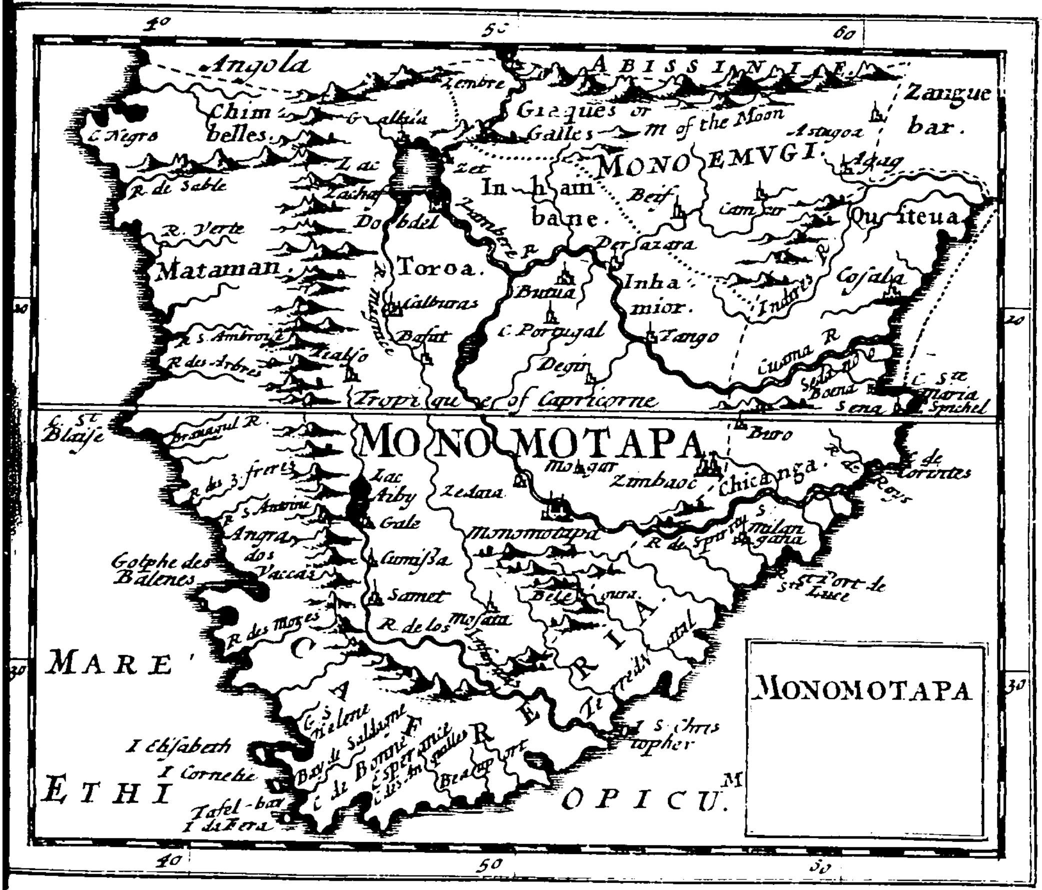

The MOLUCCA Isles
ICELEBES
Celebes
Manado
Ternate
Tidor
Motir
Machian
Bachian
Batochina
I. Guillaume Schouten
Terra des Papous
Bilato
Oubi
Xulla
Bouro
Ceram
Amboina
Banda
Boton
Nle Guinee
I. Mathieo
OCEANus ORIENTALis sive MARE
INDICUM.
I. Timor
Ombo
Solor
The Equinoctial


Isles of IAPAN
OCEANUS
the Penisula of Corea
Tango
Meaco
NIPHON
Ochio
Iedo
XIMO.
XICOCO.
Amanguchi
Tondoxima
Nambu
Sacata
Bandel mines d'Argent
Inoxima
MARE ORIENTALE.

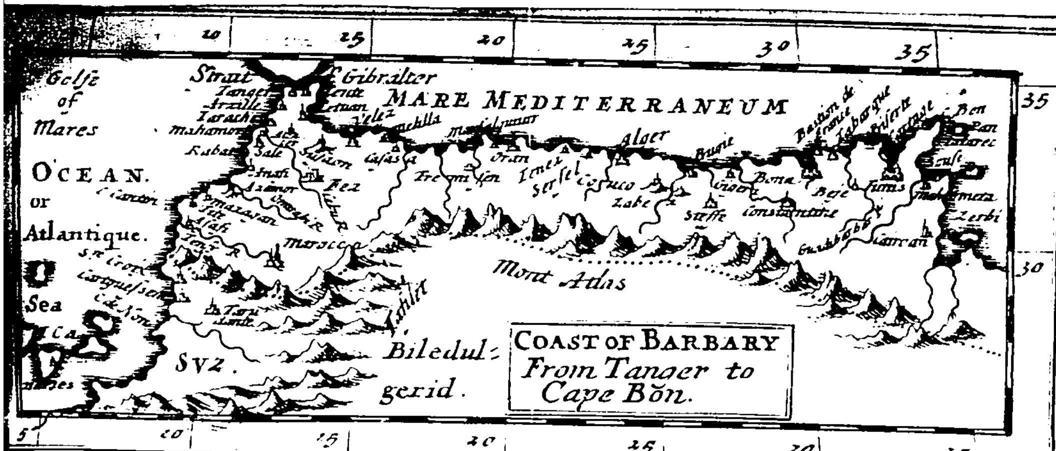
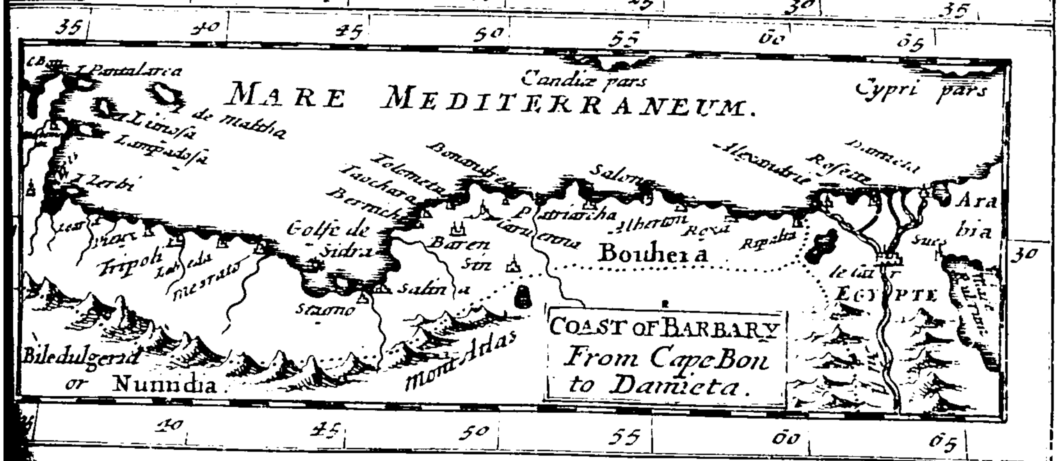
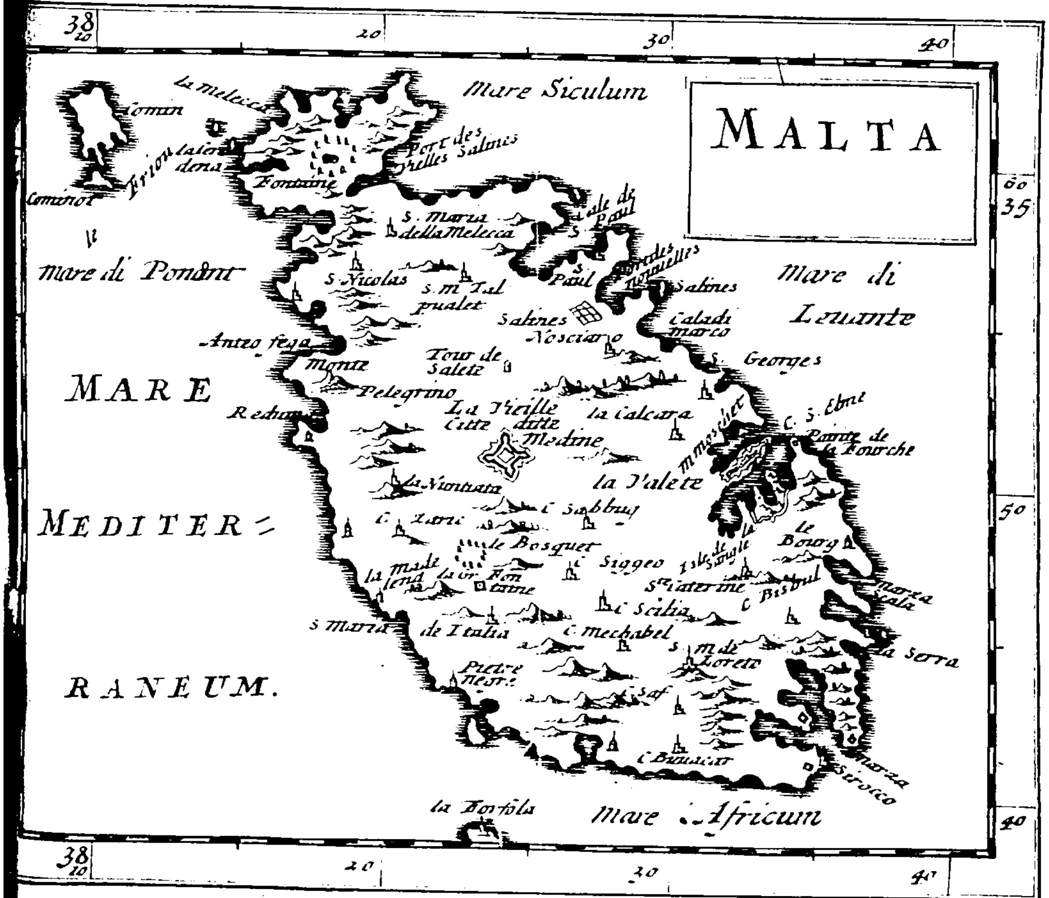

The PHILIPPINE Islands.
MARE
INDICUM
OCEANUS
ORIENT
C Bajador
Lucon
Manilhe
Luconia
Nra Segouia
Cagaion
Ancon triste
Pondam
Baye de Cavite
Mindara
Tendaye or Philippine
Passage de Sa Claire
Panagouon
Paragoya et Calamianes
Cebu
Matan
Pulovan
I. Borneo
Isle Mindanao
Mindanao
S. Juan
Punta de galera
Tagima
I. Thinosa
Paneuasion


AFRICA
MARE MEDITERRANEUM
St of Gibraltar
Tanger
Fez
Alger
Tunis
Marocco
BARBARIE
Tarudante
Allas M.
Tripoli
Barca
Malta
Candie
Cyprus
Alexandria
Terra Sancta
ASIA
I Terceres
I Madera
I. Canaries
BILEDVLGERID.
Ammon
Zanhaga
ZAARA or DESERT
EGYPTE
Suez
Tor
Mare Rubrum
Medina
Trop. of Cancer
Mecca
Ziden
Arabia
Mocca
Aden
Arguin
Gaoga
Borno
Nubie
Suaquem
NIGRITARUM REGIO
Tombut
L. Guarde
Senega R
C. Verd
Gorée
I. of C. Verd
NVBIA
Gueguere
Aber
Gorham
Niger R
L Borno
Caragolis
Arquico
Caxumo
OCEANUS
ATLANTICUS
Benin
GVINEE
Cachneu
C. Serra Liona
Biafara
ABISSINIE
Adel
ZANGVEBAR
Adea
Adhegena
I. de Prince
I. S. Thome
L Niger
Nil R
Gonthar
Amara
The Equinoctial Line
The first meridian
I S Matheo
I Annobon
CONGO
ETHIOPIA
Zaire R
S. Salvador
Melinde
Mombase
L Zaflan
Lac Zaire
Quiloa
MARE ETHIOPICUM
l'Ascension
Angola
Mosambique
m. de la Lune
C Natal
I. Ste Helene
C. Negro
MONOMO
Matataman
Zofala
Madagascar
I Maurice
I. Bourbon
F. Dauphin
OCEAN
Trop. of Capricorne
TAPA
Zimbaoe
Monomotapa
CAFRERIE
T de Natal
C de Bonne Esperance
MARE INDICUM

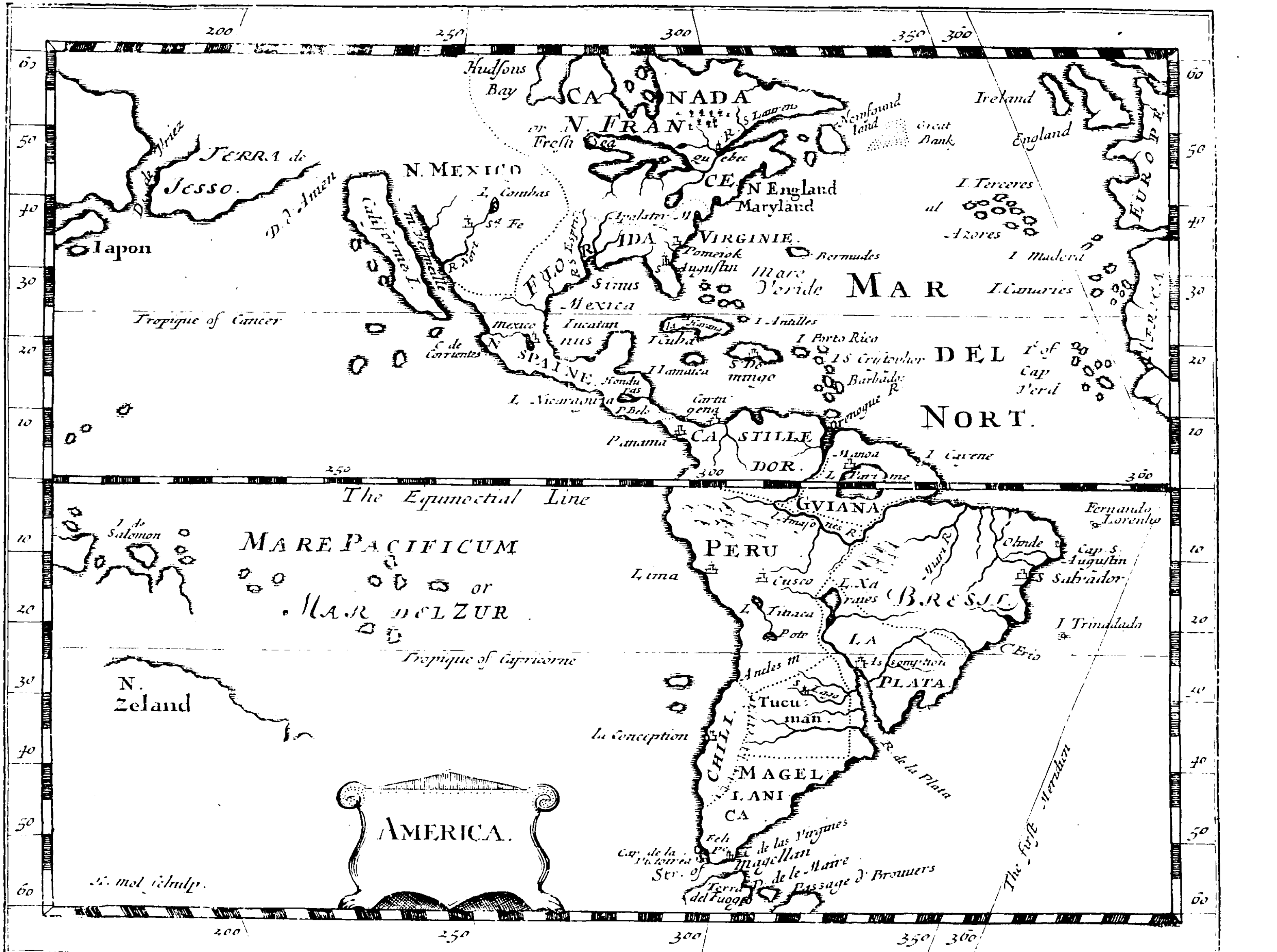
GUINEA & NIGRITARUM REGIO.
THE DESERT.
NIGRITARUM REGIO
GVINEA.
MARE GVINEÆ.
Linea Equinoctialis
Teguza
Ghir
Targa
Lempta
Berdoa
Gulata
C. Blanc
I. Arguin
Hoden
R. S. Jean
Godia
Agades
Tassana
Ghir R.
Gaoga
Garama
Borno
Gangara
Canna
Mayma
Lac de Guarde
Genehoa
Tombut
Berissa
Niger R.
Mura
Cano
Casse na
Tirca
Mezussa
Lac Borno
C. Verd
Senega R.
Gambea R.
Biafares
Salia
Tocrur
Dau
Guber
Niger R.
Zanfara
Caceres Bonaes
Gago
Lamlem
Zeg zeg
Biguba
Songo
Beria
Melli
Great Acanes
Caragolis.
Bito
Tibet dera
Sousos.
Less Acanes
Medra
I. des Idoles
Xabanda
Caceres
Abaraus
Cosfo
Benin
Budis
Biafara
Dauma
C. Tagrin
Cachieu
R. Sierra Liona
Maleguete.
Lamo
S. Lorenso
Curano
Arda
Orerre
Gold Coast
C. Corso
George de la Mine
Ambosins.
R. Real
R. del Rey
R. Camarones
Borca
Capons.
Gr. Sestre
C. des Palmes
Axien
C. des 3 Puntas
C. Formoso
I. Fernando Poo
Lacus Niger
I. du Prince
Gabon
CON-
GO.
I. S. Thome
Cabo de Lopo Gonzalues
I. Annobon



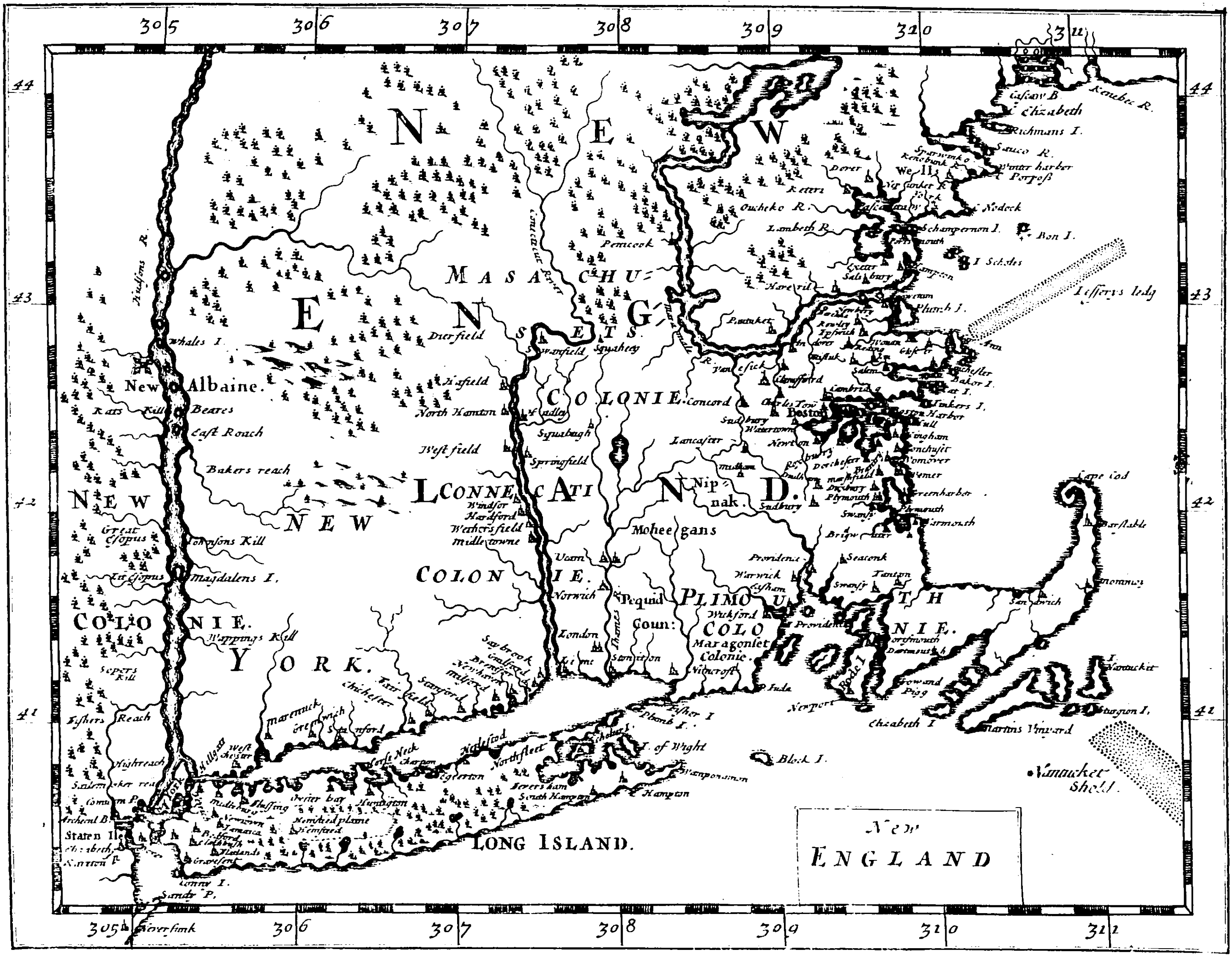
MONOMOTAPA
Angola
ABISSINIAE
Zangue bar.
Chim belles.
C. Negro
Giaques or Galles
m of the Moon
MONO EMVGI.
Astagoa
R. de Sable
In ham bane.
R. Verte
Mataman.
Toroa.
Inha mior.
Cosala
Butua
C. Portugal
Tango
Cuama R
Degin
Tropique of Capricorne
C. St Maria
Spichel
Sena
C. St Blaise
MONOMOTAPA
Zimbaoc
Chicanga.
Lac Arby
Zedara
Monomotapa
R de Sprito
Golphe des Balenes
Angra dos Vaccas
Samet
R. des Moges
MARE
ETHI
OPICU.
M
C A F R E R I A.
I Elisabeth
I Cornelie
Tafel-bar
I de Rora
C. de Bonne Esperance
C. S Helene
Bay de Saldagne
I. s. Christopher
Terre de Natal
St Port de Luce
40
50
60
20
30


COAST OF BARBARY
From Tanger to
Cape Bon.
MARE MEDITERRANEUM
OCEAN.
or
Atlantique.
Golfe of Mares
Strait
Gibralter
Mont Atlas
Biledul=
gerid.
SUZ.
Alger
Bona
Tunis
Fez
Marocco
Oran
Constantine
Sale
Tanger
Ben
Zerbi
Sea

COAST OF BARBARY
From Cape Bon
to Damieta.
MARE MEDITERRANEUM.
Candiæ pars
Cypri pars
Bouhera
EGYPTE
Arabia
Tripoli
Golfe de Sidra
Mesrata
Biledulgerid
or Numidia
Mont Atlas
Alexandria
Rosette
Damieta
Salone
Lampadosa
I. Zerbi
Bernich
Tolometa
Suez

MALTA
Mare Siculum
Mare di Ponent
Mare di Levante
MARE
MEDITER=
RANEUM.
Mare Africum
Comin
Cominot
S. Paul
Salines
La Vieille Citte dite Medine
la Valete
la Calcara
S. Georges
le Bourg
la Serra
la Torfola
Pelegrino
S. Nicolas
C. Scalia
C. Mechabel
de Italia


Isle of MADAGASCAR
ZANGV- BAR
AFRI CA
I. Iohanna
le Comore
C. St Sebastien
C. Natal
Vohemaro
St Marie
or
Nossi Ibrahim
Port aux
prunes
I. mauritius
OCEANUS
MERIDIONALIS
Tropique of Capricorne
Fort Dauphin
Manshere
St Luce
Augustin

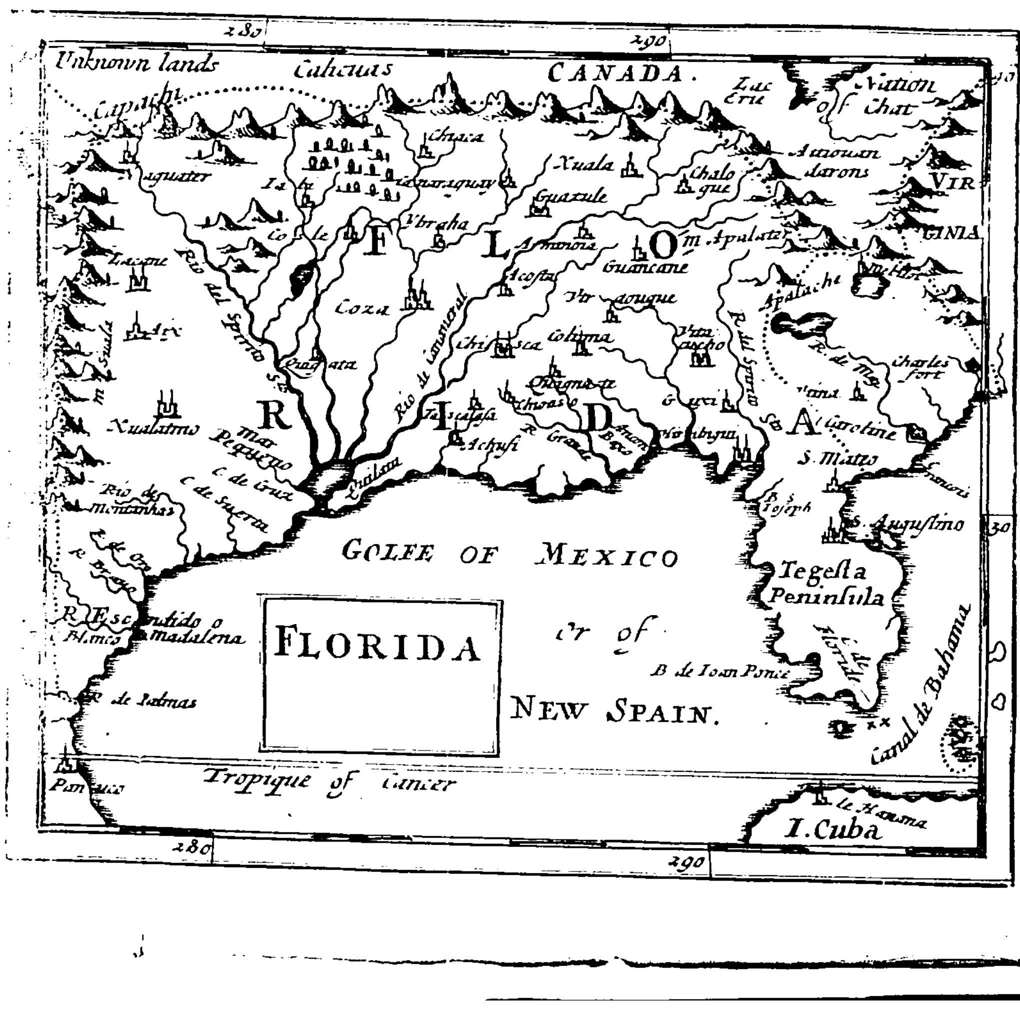

AMERICA.
Hudsons Bay
CANADA
N. FRANCE
Fresh Sea
S Lauren R.
Quebec
Newfound land
Great Bank
Ireland
England
EUROPE
TERRA de Jesso
Iapon
N. MEXICO
Sta Fe
California I.
N England
Maryland
VIRGINIE.
I. Terceres
Azores
Bermudes
I. Madera
Mare Verde
MAR DEL NORT.
I. Canaries
Tropique of Cancer
Sinus Mexica
Mexico
Yucatan
I. Cuba
Hamaica
I. Antilles
I. Porto Rico
Barbados
Cap Verd
AFRICA
Panama
CASTILLE DOR.
GVIANA
The Equinoctial Line
Fernando Lorenho
PERU
Lima
Cusco
BRESIL
S. Salvador
I. Trinidado
I. de Salomon
MARE PACIFICUM or MAR DEL ZUR.
Tropique of Capricorne
LA PLATA.
Tucuman.
CHILI
La Conception
MAGELLANICA
R. de la Plata
N. Zeland
Str. of Magellan
Terra del Fuego
Passage d' Brouwers
The first Meridian
S. mol sculp.


ZANGUEBAR
Arabia
Aden
Strait of Bebelmandel
I. Zacatora
Degibeldora
Zeila
Dangali.
Barbora
Meta
Dardora
Comizara
Carfur
A mountaine with a Lake a top
ABISSINIA
ADEL
Granze
Badeus
Dalli
Angote
AD EA
AJEN.
Costa Deserta
OCEANUS
Magadoxo
Brava
Fungi
Linea Equinoctialis
INDICUS
Rosanegus
Melinde
Mombaze
Simus
I. Pemba
Banc de Patram
I. Mascarenhas
S. Miguel
Bara
Camu
ZANGUEBAR
I. Zanzibar
I. Natal
I. Monfia
Quiloa
Aco
Agulha
Sibit
C. Delgado
C. S. Sebastien
Querimba
Angoche
I. de Comore
Akiola
Madagascar
Mozambique
I. Nona
Nazareth
Baye d'Antongil
Garatos


New ENGLAND
NEW ENGLAND
MASACHUSETS COLONIE
CONNECATI COLONIE
PLIMOUTH COLONIE
NEW YORK COLONIE
NEW COLONIE
LONG ISLAND.
New Albaine.
Boston
Cape Cod
Block I.
Providence
Newport
Hartford
Springfield
Concord
Charles Town
Plymouth
Salem
Kenebec R.
Richmans I.
Saco R.
Winter harbor
Porposs
Wells
Dover
Portsmouth
Hampton
Salisbury
Exeter
Newbery
Rowley
Ipswich
Hudsons R.
Whales I.
Rats Kill
Beares
East Rouch
Bakers reach
Great Esopus
Johnsons Kill
Magdalens I.
Wappings Kill
Sepers Kill
Fishers Reach
Staten I.
Sandy P.
Deerfield
Hatfield
North Hamton
Hadley
Westfield
Windsor
Hardford
Wethersfield
Middletowne
Norwich
London
Stonington
Pequid Coun:
Mohee gans
Maragonset Colonie.
Wickford
Warwick
Nipnak.
Lancaster
Watertown
Sudbury
Dorchester
Dedham
Duxbury
Barnstable
Sandwich
Yarmouth
Nantucket
Martins Vinyard
Elizabeth I.
Fisher I.
I. of Wight
Southampton
Hampton
Huntington
Hempstead
Jamaica
Newtown
Flushing
Gravesend
Flatlands
Stamford
Greenwich
Milford
New haven
Branford
Guilford
Saybrook
Long Island
Jefferys ledg
Nantucket Sholl.

VIRGINIA.
MARYLAND
VIRGINIA
NEW KENT
ACCOMOC
TALBOT C.
DORCHESTER C.
STAFFORD CO.
CHARLES CO.
CALV ERT
S.T MARY CO.
WESTMERLAND
NORT HUMBERLAND
LANCASTER C.
MIDDELSEX C.
GLOSTER C.
RAPPAHANOCK
CHARLES CITY C.
HENRICO
SURRY C.
ISLE OF WIGHT C.
NANT-EMOND C.
YORK C.
WARWICK
ELIZABETH
NORTHAMPTON
Patowmeck R.
Rappahanock R.
York R.
James R.
C. Charles
Cape Henry
The Great bay of Chesapeake.
A Scale of twenty English miles.
302
303
39
38
37


New MEXICO
CANADA or New France
ANIEN
QVIVIRA or N ALBON
APACHES Vaqueros
I. CALIFORNIA
MAR VERMEIO
Port de Monterey
B. de la Conception
B. de tous les Saints
I. S. Clemente
MAR DEL SVR or PACIFIQUE. SEA.
Tropique of Cancer
QVIVIRA ORIENTALIS
NEW BISCAIE
NEW SPAIN or MEXIQVE.
C. S. Lucas
Socorro
Tobosos
Zaguata
240
250
260
270


FLORIDA
Unknown lands
CANADA.
Nation of Chat
VIRGINIA
F L O R I D A
Coza
Apalache
Charles fort
Caroline
S. Matteo
S. Augustino
Tegesta Peninsula
GOLFE OF MEXICO or of NEW SPAIN.
Canal de Bahama
Tropique of Cancer
Panuco
I. Cuba
le Havana
Mar Pequeno
Rio del Spirito S.
280
290


BRAZILL and LA PLATA.
GVAIANA.
L. Parime
Linea Equinoctialis
S. Anne
Costa Baxa
Siara
C. Cors
Rio Grande o potenque
Paraiba
Tamaraca
Olinde Recif
Pernombuco
C. S. Augustin
Mataya.
Bosphore
Tapagazu
Toupinambous
Seregippe
R. Real
S. Salvador
Baia de to dos los santos
Los Ilheos
Aymures
Tapiries
P.o Seguro
Margaias.
Spiritu St.
Xaquesses
Pories
Paraguaei
PARAGVAI.
PERU
S. Ignace
Villarica
S. Vincent
Taioba.
I. des Francois
Tropick of Capricorn.
Guaira.
Assumption
Le S Sacrements
Parana
Las 7 Corrientes
R. Negro
Tierra dos Patos
S. Miguel
S. Iago del Estero
TVCVMAN
Corduba
Trapalanda
Buenos Aires
Ciudad de la Trinidad
Quirandies
Rio de la Plata
R. Grande
Porto de S. Pedro
de St. Marie
de St. Antoine
MARE DE BRASILIA
MARE DE PARAGVAI.
320
330
340
350
10
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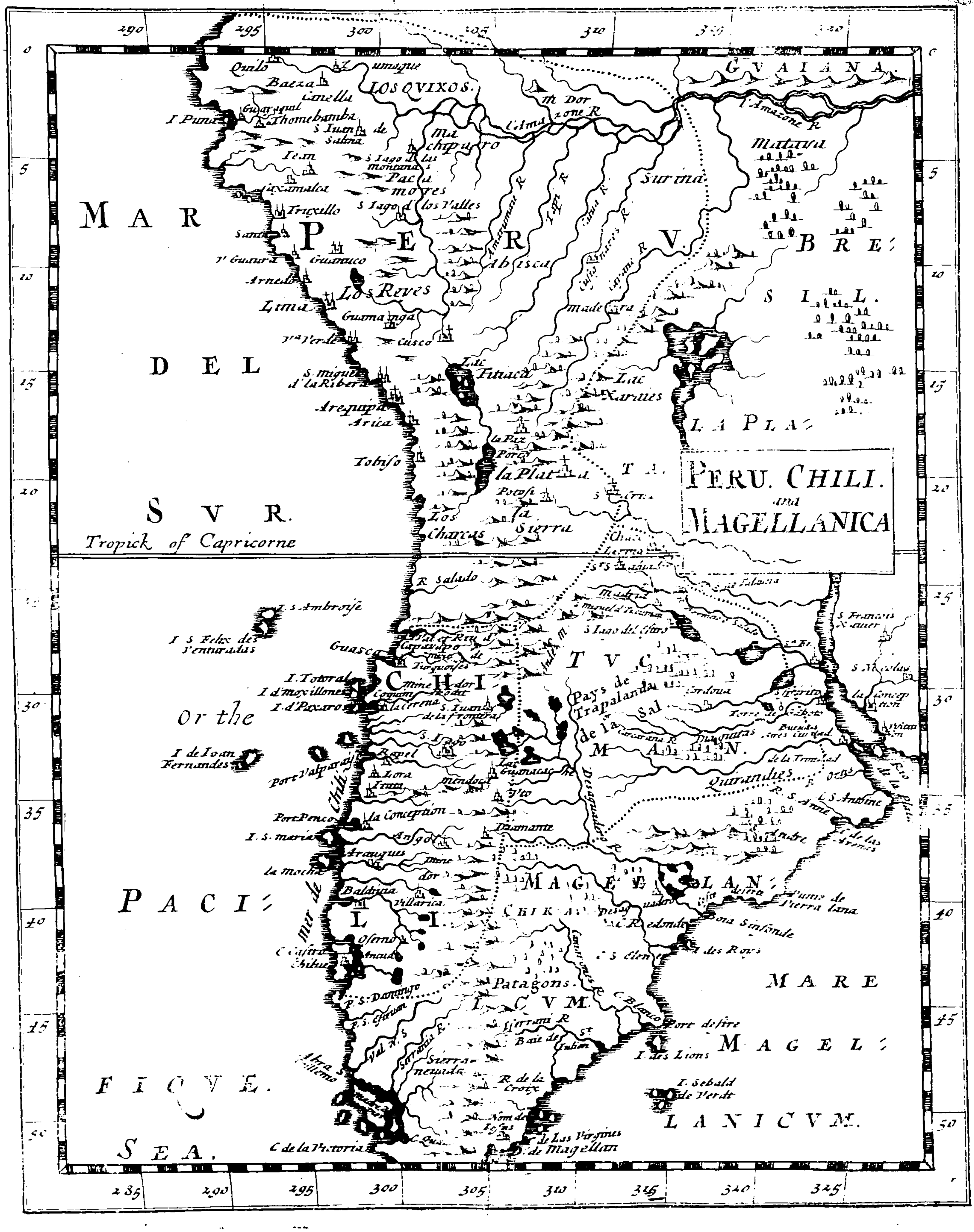
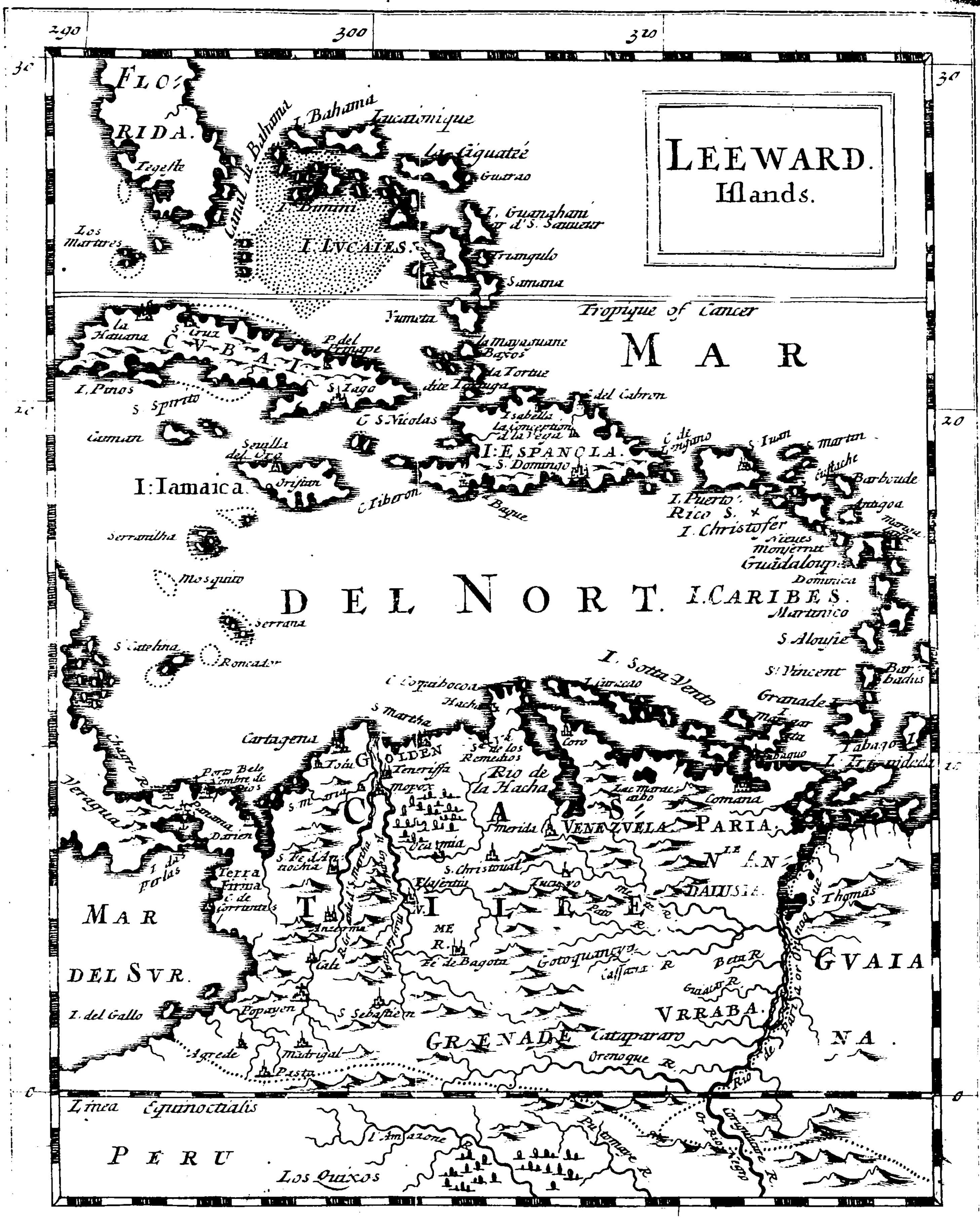
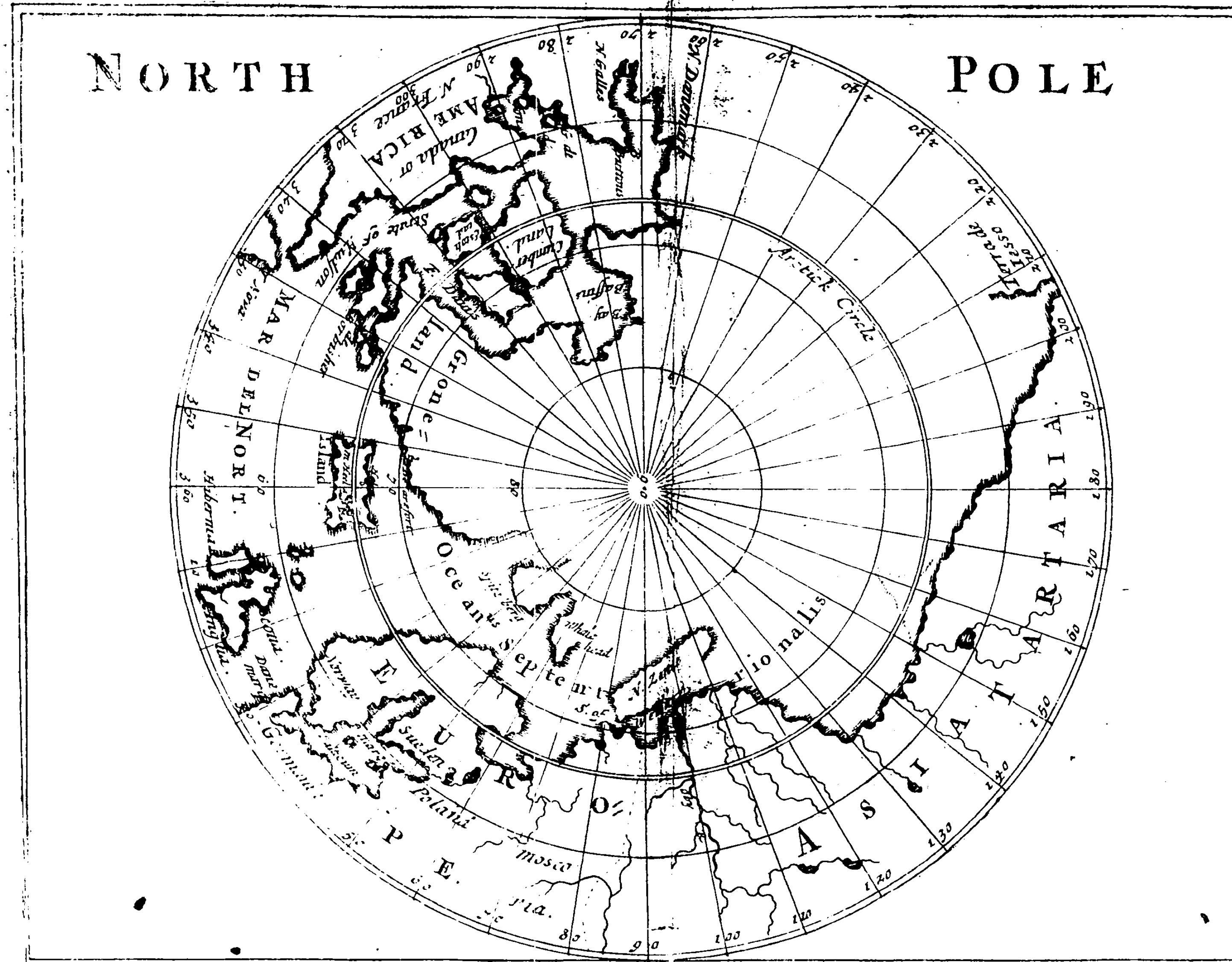
NEW SPAIN
GOLFE OF MEXICO
Tropique of Cancer
MAR DEL NORT
GOLFE OF HONDVRAS
MAR DEL SVR
or
PACIFIQVE. SEA
NEW MEXICO
FLORIDA Deserta
N BISCAIE
Mexico
HONDVRAS
NICARAGVA
Costarica
Cuba

GUIANA
MAR DEL NORT
GOLDEN CASTIL
ARWAQVES
CARIBES
GVIANA
CARIPOV
Lac Parime or Roponowini
Linea Equinoctialis
AROVVACAS
Amazone R.
PEROV.
BRESIL.


PERU. CHILI. and MAGELLANICA
MAR DEL SVR.
Tropick of Capricorne
Or the
PACIFICQVE. SEA.
GVAIANA.
LOS QVIXOS.
PERV.
BRESIL.
LA PLATA
CHILI
TVCUMAN
MAGELLANICVM.
MARE MAGELLANICVM.
Quito
Baeza
I. Puna
Thomebamba
S. Juan de Salina
Trruxillo
Guanuco
Los Reyes
Lima
Guamanga
Cusco
Arequipa
Arica
Tobiso
la Paz
Potosi
la Plata
Los Charcas
la Sierra
Lac Titiaca
Lac Xarayes
L'Amazone R.
Surina
Abisca
Madera
R. Salado
I. s. Ambroise
I S Felix des Venturadas
Guasco
I. Totoral
I. d'moxillones
I. d'Paxaros
I. de Ioan Fernandes
Port Valparaiso
S. Iago
mendoça
la Conception
Port Penco
I. s. maria
la mocha
Baldivia
Villarica
Osorno
C. Castro
Pays de Trapalanda
Cordoua
Rio de la Plata
S. Antoine
C. de las Arenas
Patagons.
Port desire
I. des Lions
I. Sebald de Verdt
C. de la Victoria
de Magellan
Sierra nevada
R. de la Croix
C. Blanco
mar de Chili

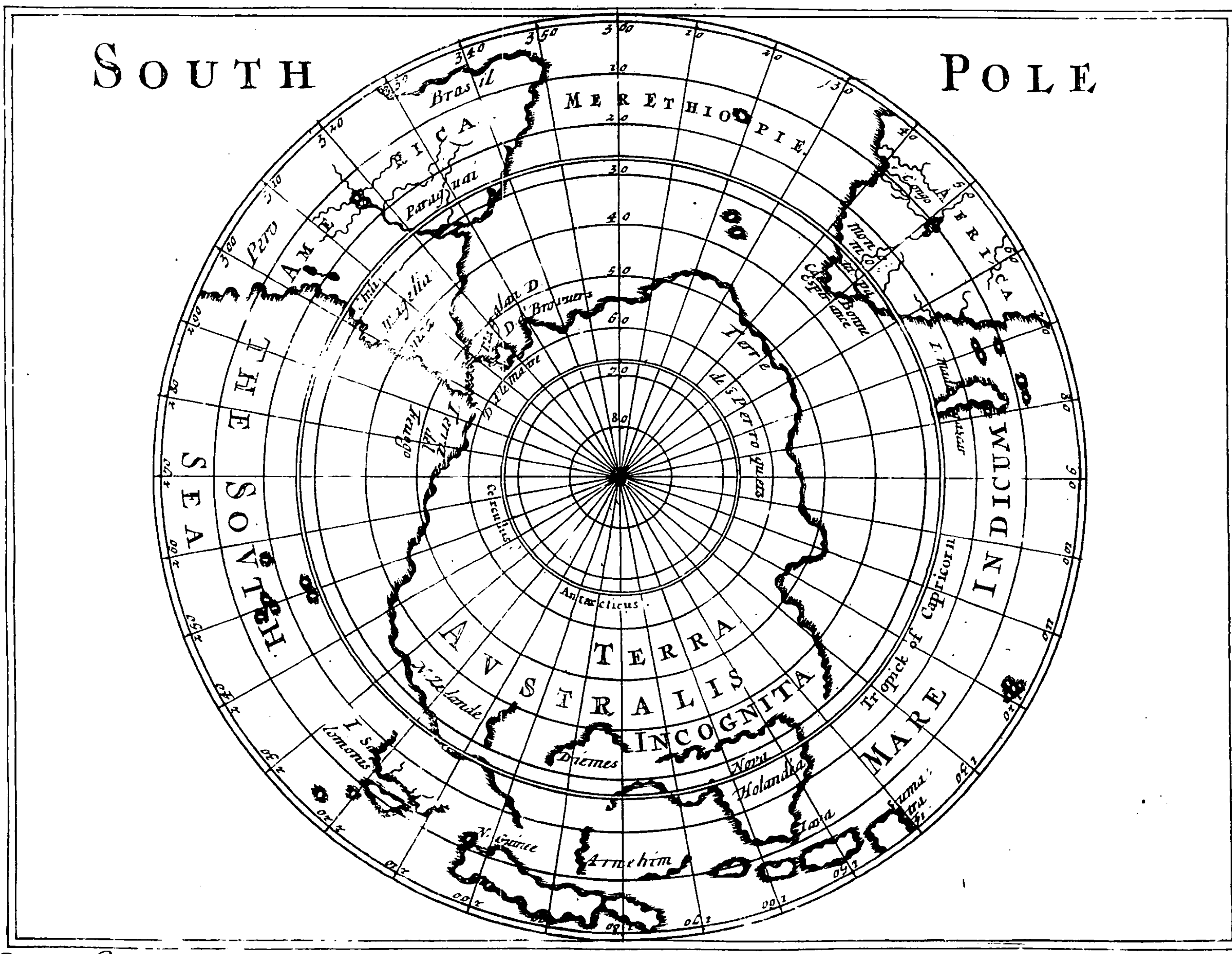


LEEWARD. Islands.
290
300
310
FLO RIDA.
Canal de Bahama
I. Bahama
Iucaionique
La Giguatee
I. LVCAIES.
I. Guanahani
Triangulo
Samana
Tropique of Cancer
MAR
la Hauana
C V B A
I. Pinos
S. Iago
C S. Nicolas
I: ESPANOLA.
S. Domingo
I: Iamaica
Serranilha
Mosquito
DEL NORT.
I. CARIBES.
Dominica
Martinico
S. Alousie
St Vincent
Barbadus
Granade
Serrana
Roncador
Cartagena
I. Trinidad
Rio de la Hacha
VENEZVELA.
PARIA.
Comana
Coro
Panama
Darien
MAR
DEL SVR.
I. del Gallo
Popayen
Agrede
Pasto
S. Sebastien
Fe de Bagota
GRENADE
VRRABA.
GVAIANA
Orenoque R.
Linea Equinoctialis
PERU
Los Quixos
S. Thomas
300
310



NORTH POLE
AMERICA
Canada or N France
Straits of Hudson
Cumberland
Bay Baffin
N Galles
Artick Circle
Gronland
MAR DEL NORT.
Oceanus Septentrionalis
Hibernia
Anglia
Dania
Sueden
Polana
Mosco
EUROPE
ASIA
TARTARIA

Pa. 31 Geogr.


SOUTH POLE
MER ETHIOPIE
AMERICA
Brasil
Paraguai
Peru
AFRICA
Congo
THE SOUTH SEA
MARE INDICUM
TERRA AUSTRALIS INCOGNITA
Terre de Perroquets
Tropick of Capricorn
Circulus Antarcticus
N. Zelande
Diemes
Nova Holandia
Armehim
N. Guinee
Java
Sumatra

Pag 30 Geogr.